International Fisheries Exhibition,
LONDON, 1883.

THE

FISHERIES EXHIBITION LITERATURE.

VOLUME XIII.

OFFICIAL REPORT BY SPENCER WALPOLE.
STATEMENT OF RECEIPTS AND DISBURSEMENTS.
SPECIAL REPORT ON THE ELECTRIC LIGHTING OF THE EXHIBITION.
CEREMONIAL AT OPENING AND CLOSING THE EXHIBITION, WITH THE ADDRESSES.
REPORT OF EXECUTIVE COMMITTEE TO GENERAL COMMITTEE.
STATISTICAL TABLES.
CONDENSED REPORTS ON THE FISHING INDUSTRIES OF THE UNITED KINGDOM AND THE COLONIES,
TOGETHER WITH THE PRINCIPAL FOREIGN COUNTRIES.

LONDON:
WILLIAM CLOWES AND SONS, LIMITED,
13 CHARING CROSS, S.W.
1884.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

13214

SL. No. 038503

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OFFICIAL REPORT

ON THE

INTERNATIONAL FISHERIES EXHIBITION.

BY

SPENCER WALPOLE.

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OFFICIAL REPORT

ON THE

INTERNATIONAL FISHERIES EXHIBITION.

I HAVE undertaken, at the request of the Executive Committee of the Great International Fisheries Exhibition—conveyed to me through the Secretary of State for the Home Department—to write a descriptive report on the collections which were brought together at the Exhibition. In accepting this duty I never doubted the extreme difficulty of making such a report either of interest or of use. The doubts, moreover, which I originally entertained were strengthened as my familiarity with the Exhibition increased. The objects which were collected at South Kensington were so numerous, the subjects which they illustrated were so various, that it seemed almost impossible for any one person to deal satisfactorily with the whole of them. But, though good grounds could consequently be urged for entrusting the preparation of this Report to a body of individuals, and for allotting to each of them a subject which has formed his special study, such a course would not have produced the result which I understood that the Executive Committee desired to secure. It was, I believe, the object of the Committee to obtain a descriptive report—based on the Exhibition—upon the fisheries of the world; and such a report might obviously have lost both symmetry and proportion if it had been entrusted to many writers.

I shall then, in the following pages, endeavour to describe as concisely as I can the condition and the value of the fisheries of most of the countries which have taken part in the Exhibition: I shall lay special stress on those exhibits which illustrate the fisheries themselves, and the industries which are dependent on them; and pass over, either without mention or with fewer remarks, the many other objects of beauty, of interest, and of value which have no direct bearing on the condition of the fisheries. I wish, in other words, to make this Report of as much use as possible to men connected with the fisheries of the world; and to summarise the information, which the Exhibition has directly or indirectly supplied, respecting their history, their condition, and their value.

I am aware, indeed, that, in adopting this course, I am compelled to exclude from my Report many matters to which it would otherwise have been necessary to allude. I can only incidentally refer to the many admirable collections of fish which were exhibited by the Governments of the United States, of Canada, of India, of Sweden, of Chili, and of New South Wales. I cannot enter into any detailed explanation of the effect which the Exhibition has undoubtedly had in encouraging the use of many kinds of the cheaper fish as food. Even the Poor Law Guardians of many unions have introduced fish into the dietary of workhouses; and, by its introduction, have both gratified the poor and promoted economy. Nor can I refer—except in the most casual way—to the very complete collection of apparatus for saving life at sea, which undoubtedly constituted one of the most important and interesting features of the Exhibition. But, though these objects had an immediate connection with the industry of the fishermen, they did not exclusively concern the fisheries of this country; and they did not directly illustrate the progress of the fisheries. With some reluctance, therefore, I must pass them over with this brief notice, and turn to the objects which will enable me to record the history, condition, and value of the fisheries of the world.

Ample material exists for such a review. All the great countries of the world, whose people are largely engaged in fishing, took part in the Exhibition. Many of them sent Special Commissioners to London to supply information on their exhibits; while the publications which were issued under the authority of the Executive Committee, and the papers which were read at the conferences inaugurated under the same auspices, contained a mass of information on almost every subject connected with the fisheries.

The collections, indeed, exhibited at South Kensington were of very unequal value.

Those from the British Islands themselves—England, Scotland, Ireland, and the Isle of Man—were naturally the most numerous and, in one sense, the most important.

Those from the United States, Canada, and Newfoundland were admirably designed to illustrate the value and nature of the great fisheries of these transatlantic countries.

A similar praise may be given to the interesting collections from Norway, Sweden, the Netherlands, Russia, and Spain.

Much interest, of a different nature, attached to the exhibits from China, Japan, India, Ceylon, and the Straits Settlements.

The Courts of Greece, Italy, and the Bahamas all contained objects to which I shall allude specially afterwards, though the Italian Court was rather caparisoned for a shop than for an exhibition.

I shall also incidentally allude to some of the exhibits from Chili, Haiti, and Hawaii.

Austria, Belgium, Denmark, France, Germany, Portugal, Switzerland, and the colony of Heligoland, sent no collections worthy of these countries.

THE HISTORICAL ASPECT OF THE EXHIBITION.

One impression which the Exhibition was calculated to produce on any reflecting mind was the similarity of the original contrivances of all nations for catching fish. From the earliest time, of which there is any historical record, fish have been caught by the hook and line, by the net, by the spear, and by the fish weir. The methods used by ancient nations may occasionally be best illustrated by observing the present practices of barbarous people: and, just as a study of the habits of savage tribes instructs us in the probable circumstances of primitive man, so an inspection of the weapons of uncivilized nations may help us to form an idea of early fishing. Take, for instance, the first of the four methods of fishing which have been adopted from the earliest periods of which man has any record. The hook and line obviously existed before either iron had been wrought into a tool or hemp had been manufactured into a thread. In the collections both of Sweden and the United States there were admirable exhibits illustrating the substitutes which man in a rude age employed and employs for iron and hemp. Among the most interesting of these were the objects collected by Professor Nordenskiöld in his Arctic Expeditions (Sweden Special Catalogue, pp. 11 and 45; General Catalogue, p. 359). The Eskimos and the Chukches still use hooks made partly of wood, partly of bone, and occasionally of copper; their lines are made of sinew, and occasionally of whalebone; their baits of the horny-red plates from the beak of the *Phaleris* *cristatella;* their nets are made of strips of sealskin, or of the sinews of the reindeer twisted together; they are sunk with pieces of bone, with teeth, and reindeer horns; while the floats are inflated bladders. In the Swedish Court there was another collection of primitive instruments used in fishing. Some of these were brought to Sweden by a Swede who accompanied Captain Cook in his second voyage round the world. Among them may be seen hooks made of wood from the Gilbert Islands; of tortoiseshell from the Sandwich Islands; of human bone from New Zealand; and of mother-of-pearl from the Caroline Islands and California. In the United States Court there was a similar collection, while the process of manufacturing with a flint instrument a piece of mother-of-pearl into a fish-hook was illustrated and explained. In the Danish Court there was a model of a kajak (Greenland), fitted for seal fishing; the hunter's instruments being made of wood and bone (p. 256, General Catalogue). In the Chilian Court there was a wooden harpoon with a bone spear-head from Tierra del Fuego (*Ibid.* p. 247), and similar examples could have been taken from other parts of the Exhibition. Homer's simile, of the man letting down the oxhorn while angling, will be understood by any one who had the opportunity of examining the primitive fishing implements in the International Fisheries Exhibition.

A visitor, therefore, at the International Fisheries Exhibition was able to trace the history of the fish-hook as it gradually passed through wood, bone, shell, copper, brass (brass hooks were exhibited from Singapore, as well as from Sweden), to iron and steel. The history of the net may probably be similarly traced from the Chukche nets of twisted sinew, or of strips of sealskin, to the modern net of hemp, cotton, or silk. It would be a mistake, however, to suppose that all nets or lines are even now made of these materials. In the Sandwich Islands, the fibre of the olona; in Chili, a creeper, the quilmeja (Catalogue, p. 246), is used for the manufacture of nets; in Sweden ropes are now made of birch bark, of the roots of firs and pines, and of hogs' bristles (Catalogue, p. 363); ropes are made in Spain of esparto grass; in Greece ropes are made of horse-hair and goats'-hair (Catalogue, p. 270); while even in the Isle of Man collection hand-lines made of horse-hair were exhibited (*Ib.* p. 131). Both nets and lines naturally require weights to sink them to the bottom, and floats to mark their position on the surface. Bones, stones, and lead are used for the former purpose. Bladders (Sweden, Special Catalogue, p. 161), water-melons (Greece, Catalogue, p. 270), gourds (India, Catalogue, p. 141), glass buoys (Norway and Sweden, Catalogue, pp. 305, 361), tin (Spain), as well as wood and cork, are used for the latter purpose.

In all these expedients it is probably possible to trace the gradual development of the fishing industry from the earliest times to the present day. The fixed appliances which man uses for the capture of fish have undergone less alteration. These appliances may be divided into two groups: first, small traps placed either in the sea or in rivers, and either drawn up from time to time, like the lobster-pot, or examined at low water, like the putt and putcher in the Bristol Channel; and, second, large enclosures which in the tideway imprison the fish which have come up with the flood from passing out to sea with the ebb; or, in fresh water, conduct the fish into a trap constructed on the principle of an ordinary mouse-trap. Engines which may be classed under one or other of these descriptions seem to have existed in all countries and in almost all ages. If I may quote a report of my own which I drew up on the Berlin

Exhibition in 1881, "The stake-nets which now fringe the shore of Scotland are identical in principle with the weirs in China, in Malacca, in Brazil, and in Borneo; with the engines which in the sixteenth century were placed on the coasts of Virginia by the aboriginal inhabitants, and which are now placed on the same coasts by the inhabitants of the United States. The nets which the Swiss use in the Rhine at Basle, the hoop-nets which the Italians use in the lakes of northern Italy, the putts and putchers which are confined to a single estuary in England, have all their counterparts in the Dutch East Indies." (Inspector's 20th Annual Report, 1881, p. 34.) I could easily illustrate the same thing from the present Exhibition; but it is probably sufficient to say that these modes of fishing prevail in almost every country and at almost every stage of civilization.

It may be added that it is not only in fixed engines that a striking similarity exists between the methods of fishing used by various nations. In the Chinese Court may be seen a model of two boats drawing between them a kind of trawl-net (Catalogue, p. 252). "At Tatapou and Haimên the larger boats always go out fishing in pairs, dragging the long trawl-net between them" (Special Chinese Catalogue, p. 3). But in the Spanish Court there is a model of precisely the same contrivance, which in Spain is called the *bou* (Catalogue, p. 345), and which the French call a *chalut;* while, though Germany is meagrely represented in the present Exhibition, any one who had the advantage of seeing the collections at Berlin, will recollect that a similar net is commonly worked in Germany in the *haffs*, or large lakes, which communicate with the Baltic (Inspector's Report, 1881, p. 30). But a still more remarkable instance may be given. In the Russian Court there is a model of some fixed rods fishing through the frozen surface of the Volga in the winter. A hole is made in the ice, through which the line passes, but the point of the rod is bent downwards and fastened to the ice with a string connected with the fishing-line, and is capable of being liberated when the line itself is jerked. The fish, taking the bait, jerks the line, liberates the point of the rod, which springs upwards and carries the line and the captured fish through the ice into the air. A man, under these circumstances, can attend to a dozen of these rods, since he has nothing to do but take the fish from the hook when it is caught, and reset the line. But, singularly enough, this ingenious method of fishing, which is practised under or upon the ice in Russia, is pursued under a burning sun in the Straits Settlements. There was at the Exhibition, in the Straits Settlements Court, "a model of a self-acting rod, made of an elastic bamboo, which is fastened in the ground and bent until the catch on the line meets a corresponding one on a short stick planted on the edge of, or a little distance from, the bank. The bait trails in the water, and the fish on taking it releases the line from the catch, the bamboo springing back and jerking the fish on to the bank" (Catalogue, p. 182). There is no difference in principle between this contrivance and the ingenious method already alluded to for taking fish in the frozen waters of the Volga.

It would be a matter of great interest, from an historical point of view, to consider whether the similarity of these contrivances points to their derivation from some common origin; or whether man, acting under the same circumstances, though in various conditions, has arrived at the same conclusions and adopted the same expedients. In other words, did the native on the coasts of Maine and the native in Malacca derive their ideas of a fish-line from a common ancestor? or did they, acting independently of each other, produce fish-lines which, except that one is made of bamboo and the other of brushwood, are practically identical?

It may be hoped that some competent person may have taken advantage of the recent Exhibition to examine such a subject as this and other kindred matters, which tend to throw light on the early history of mankind. In this Report it is impossible to do more than indicate their nature.

Observations such as those which I have made in the preceding paragraphs may be made by any one who has inspected the Exhibition with care. I terminate them with regret to describe the exhibits of the various countries. In doing so I shall, I hope, add interest to the Report if I endeavour, as far as possible, to arrange the different countries in groups; and the first group which it will be desirable to examine is that of the

ORIENTAL COUNTRIES,

China, India, Japan, Ceylon, and the Straits Settlements. Speaking generally, these collections were of very unequal importance. That from India had the interest which attaches to a well-arranged museum; that from Japan would have furnished an admirable shop. Those from Ceylon and the Straits Settlements were of more value from a fisherman's point of view; while the collection from China admirably illustrated the fisheries of a great province (Swatow) of the Chinese Empire.

THE STRAITS SETTLEMENTS.

The Straits Settlements contained in 1881 a population of 423,384 persons. The population consists of Europeans, Malays, Chinese, and natives of India. "Fish forms, with rice, the principal article of food among all the native races. This is especially the case as regards the Malays, while the Chinaman, if he can afford it, will supplement his meal of rice and fish with a small quantity of pork." The Chinese and the Malays together embrace, it ought to be added, four-fifths of the population. "To supply the various markets, about 10,000 persons are wholly employed in fishing operations" (Catalogue, p. 181). The models of the instruments used by them, which were at the Exhibition, were really very valuable. The resemblance which many of them bear to contrivances in use in other countries has already been pointed out. From a fisherman's point of view they are otherwise more remarkable for the ingenuity which they display than for their actual efficiency. For instance, there is a model in the court of some fishermen fishing with lines which are carried out to some distance from them by an ordinary kite. It is impossible to avoid admiring the ingenuity of a man who uses a kite to carry the line further away from him. But it is difficult to help contrasting it with the system of the hand-line fishermen who, fishing with two hand-lines, pull out cod on the banks of Newfoundland almost incessantly; or with that of the long-line fishermen, who place a line with some thousand baited hooks upon it at the bottom of the sea. The spectator is almost tempted to imagine that time has no value and labour no price among the easy-going people of Malacca and Singapore.

CEYLON.

In Ceylon, a colony which is situated a few degrees to the south of the latitude of the Straits Settlements, a somewhat different state of things exists. Here, as in all the Indian waters, the seas are described as teeming with fish. According to the author of the preface to the Ceylon exhibits: "Hardly any place in the world has been so richly endowed in this respect by nature as Ceylon" * (Catalogue, p. 167). But, if this be the case, the Cinghalese hardly derive as much benefit as they should from the wealth of the seas. Ceylon contains a population of about 2,750,000 people; 6400 boats are said to be engaged in the fisheries; and nearly 20,000 men are employed in them. Yet the present annual value of the fish caught is only £150,000; while the Cinghalese import salt fish, worth £47,000, and weighing 2800 tons, from British India, † and 1600 tons of salted fish, worth £27,000, from the Maldive Islands. It is obvious, therefore, that the 20,000 fishermen of Ceylon do not succeed in supplying the home markets, and that the Cinghalese are largely dependent on other nations for their supply of salt fish.

Up to 1840, the fisheries of Ceylon were in the hands of the Government, and formed consequently a monopoly. The abolition of the monopoly in that year has largely increased the production. The value of the fish taken has risen in the interval from £48,000 to £150,000. The

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* It is a curious proof of the amazing fertility of the sea that many of the authors of the Prefaces in the Catalogue have drawn attention to the marvellous fecundity of the waters around the countries whose fisheries they were describing. Each writer seems to have imagined that this fecundity must have been exceptional in his own particular case, while, on the contrary, it would be much more true to say that it was universal.

† These figures are taken from the Official Catalogue. Assuming that they are accurate, the Cinghalese are paying a large sum for their salt fish. A barrel of Scotch herrings weighs rather more than 2 cwt. and is worth about 30*s*. or less than £15 a ton. The salt fish which the Cinghalese buy from India costs them £17 a ton.

author of the preface to the Ceylon exhibits thinks that the establishment of large fish-curing industries would stimulate their growth. But perhaps it is more legitimate to infer that the introduction of more economical modes of fishing would do more good to the Cinghalese than the provision of large fish-curing establishments.* In Newfoundland—as will be seen later on—every fisherman is a curer; and the arrangements, which have made Newfoundland, in proportion to its population, the most productive fishing station in the world, seem more applicable to a place like Ceylon than the more expensive methods—for the division of labour—which are adopted in more advanced communities. In examining the Ceylon exhibits, as in the case of all the Oriental courts, moreover, the visitor is more struck with the ingenuity of the Cinghalese than with the efficacy of their instruments. Except the Madel net, and, to a lesser extent, the Barudel net, both of which are really nothing but draught-nets, respectively 600 and 400 yards long (Catalogue, p. 169), there is really no instrument in use in Ceylon capable of taking fish on a large scale. If the writer of the preface, which I have so often quoted, is right in saying that "the nets are often very large and costly, some being worth £150," it seems certain that, either none of those large nets were exhibited at South Kensington, or that the Cinghalese could purchase their nets much more cheaply in this country than they can manufacture them in Ceylon.

The reflection, which most people will make on examining the fishing instruments of the Cinghalese, will also occur to them on looking at the models of their boats. Some of them are among the most interesting objects collected at the Exhibition. The Pada boats, for instance, or twin boats, "united by a plank flooring with a plank superstructure attached," might have given the idea to the inventor of the *Calais Douvres.* The modern outrigger had its prototype in the ordinary canoe of Ceylon, though the outrigger in Ceylon, not only increases the power of the paddles, but simultaneously adds stability to the vessel. Probably these outriggers are some of the best contrivances devised by man to prevent a boat from being upset in a heavy surf. But, though the Cinghalese have invented boats which would do credit to a mechanical engineer, their vessels are made after the primitive methods in use among primæval men. In Charles Lamb's amusing essay, a Chinese sage is represented as having, in process of time, discovered that the flesh of swine might be cooked without the necessity of consuming a whole house to dress it. The Cinghalese do not seem yet to have learned that a boat can be built without using a whole tree to build it. The log which they require for a boat is cut down, and hollowed out by the action of fire, or otherwise.

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* It will be seen later on, in the review of the Indian exhibit, how injuriously the existence of a tax on salt affects a fishery. The Ceylon fishery is probably seriously injured by the existence of the Government monopoly on salt.

In addition to the fishery for sea-fish, there is, of course, a considerable fishery for pearl-oysters. Unlike the fishery for sea-fish, the pearl fishing is a monopoly in the hands of the Government. It is stated in the Catalogue (p. 167) to have produced 18,000,000 oysters in 1881, which were sold for £50,000. The fishery, it is well known, is conducted by divers; but there were no collections at the Exhibition intended to illustrate it. I believe, however, that its yield is very variable; and that its present value is far inferior to its produce in previous ages.

INDIA.

The Indian collection is naturally much larger than that of Ceylon ; but the collection from India has the radical defect that it consists mainly of objects suitable for a museum, and not of exhibits intended to illustrate the fisheries of the country. The Catalogue, however, is enriched by a valuable preface on the Indian fisheries from the pen of Dr. Day ; and the same gentleman has contributed one of the handbooks, issued in connection with the Exhibition, on 'Indian Fish and Fishing.' Dr. Day's observations seem well worthy the consideration of the Indian Government. "Wherever the fisherman or fish-curer can obtain salt at a cheap rate, there marine fisheries flourish ; where it is dear, his occupation is destroyed, except for the purpose of supplying daily wants, and a small surplus for salting or sun-drying" (Handbook, p. 4). In olden times salt was allowed duty free in British territory for salting fish ; but this enactment was repealed because the Excise officers found that it assisted smuggling. The fishermen and fish-curers have done their best to escape from the injurious consequences of the tax. They have used, whenever they were allowed to do so, salt-earth in lieu of salt. Such an use could not, in one sense, develop the trade. Salt-earth "imparts a bitter and unpleasant flavour, and is believed to engender disease. But," adds Dr. Day, "the poor cannot be particular respecting the taste or smell of their food—expense being usually the most important consideration." Eighty-two lbs. of salt cost 4*s.* at the present time : 246 lbs. of salt-earth—the equivalent of 82 lbs. of salt—may be purchased for 1*d.* Notwithstanding, therefore, the smell and the flavour, and the risk of disease, the poor are compelled to be satisfied with fish cured with salt-earth.

The result is the more unfortunate, because the salt-tax applies only to British territory. "Along the coasts of Beloochistan, where there was no salt-tax (1873), large communities were entirely supported by fisheries, their captures being cured or exported for the Indian or Chinese markets. The same remark applied to the Portuguese settlements of Goa, Daumaun, and Diu, the salt used there costing about 3*d.* per 82$\frac{2}{7}$ lb. weight, whereas in the contiguous British territory it stood at the salt pans at about 4*s.* Hence the foreign fishermen were able freely to use this condiment; the cured article was preserved in a superior manner, more wholesome to the consumer, and able to be carried further inland" (Handbook, p. 9).

Happily, this injurious state of things is being slowly altered. "During the last few years the system of bonded enclosures, within which fish may be cured with free salt, has been tried at Madras, and it is to be hoped that it will be found practicable to introduce it to all other parts of British India." (Handbook, p. 8). The experiment seems to be successful. "The industry of salting fish is really commencing at last; 400 tons more were salted this year than last, and 80 more yards for curing are to be opened in a month or two. The amount cured in the Madras Presidency was 1734 tons in 1882" (*Ibid.* p. 7, note) while at the confluence of the Ganges and Brahmapootra, where 1362 maunds (112,073 lbs.) of fish were cured in 1875; no less than 14,000 maunds (1,155,288 lbs.) were cured in 1878 (*Ibid.* p. 55).

The discouragement which the heavy tax on salt has produced has naturally restricted the operations of the fishermen. The sea-fishermen used to be divided into two classes: "(1) those who captured fish in the deep sea, or beyond their own depth; and (2) others who fished from the shore and in the backwaters and creeks" (Handbook, p. 16). According to Dr. Day, the salt-tax has had the effect of crushing out the former class, which comprised what in this country would be called the genuine fishermen; and the supply of sea-fish is now almost solely obtained by foreshore fishing. It is not, under these circumstances, remarkable that a large proportion of the fish is caught in tidal ponds, or by dams, weirs, stake-nets, or other fixed engines. Models of some of these and of the smaller engines in use were exhibited in South Kensington. There was nothing in these models, however, which require any special remark here. Fish are also caught in some parts of India with drift-nets, draft-nets, dip-nets, cast-nets, as well as with hook and line. If Dr. Day is right in saying that "in Sind a net suitable for sea-fishing would involve the outlay of £40 or £50" (Handbook, p. 12), it may be hoped that the Exhibition may be the means of teaching Indian fishermen that they can procure their nets much more cheaply by importing them from England.

The seas of India contain vast quantities of fish. But the great rivers, with which India is watered, also support numbers of fishermen; and in India, as in every country where rice is grown and land is flooded in its cultivation, large quantities of fish-fry are taken on the flooded land. Baskets and scoops used for their capture may be seen in the collection of the Straits Settlements (Catalogue, p. 182). A description of the methods by which fish-fry are thus taken in India will be found in Dr. Day's Handbook (p. 29). And the same practice exists in China (Special Chinese Catalogue, p. 9). But the most important inland fisheries in India are those for the anadromous or migratory fish, especially for the hilsa (one of the *Clupeidæ*) and for the mahaseer (a gigantic member of the Barbel family). These fish are taken, practically without restriction, by fixed engines, by moveable engines, by what we should call in this country snatching, and by other devices. There the fixed engine stands, writes Dr. Day, "immovably fixed across an entire waterway, capturing everything, the water being literally strained through it. In one instance in the Punjaub, a whole drove of mahaseer were observed to be captured by natives fixing a net across a river, and then dragging another down to it, thus occasioning wholesale destruction. . . . This plan is a very common procedure throughout India, as is also constructing earthen dams across streams, leaving a channel or opening through their centre, where a purse-net is fixed and arrests every descending fish" (Handbook, p. 43). It is singular, in connection with what I have already mentioned, to observe how closely the devices for taking fish wholesale in inland waters in India, resemble those which ruined the fisheries of so many rivers of the United Kingdom.

JAPAN.

I have already mentioned that the interesting exhibition from British India bears too much resemblance to the collections of a museum; the few objects which are shown from Japan strike the observer as not inappropriate furniture for a shop. A few specimens of lines, nets, hooks; a few samples of preserved fish, of kinds "unknown, with few exceptions, in the European markets," a little isinglass, glue, manure, and oil obtained from fish—form almost the only objects of any practical interest in the Japanese Court. I chiefly allude to them, because the Jurors have

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drawn special attention to the manure, and shown that the so-called guano, by the more thorough extraction of oil and water and by reduction to a fine powdery condition, might be made a very valuable fertiliser; and that the oil, though possessing strong medicinal properties, was not palatable. I pass on from a court, in which it is impossible to learn much, and about which there are no other means of acquiring any knowledge, to the important collections exhibited from China.

CHINA.

To understand this Exhibition rightly, a word of caution is necessary. Sir Robert Hart, the Inspector-General of Customs for the Chinese Empire, to whom the task of preparing it was assigned by the Chinese Government thought that the invitation had arrived too late to admit of any very extensive collection to illustrate the whole of the Chinese fisheries. He decided, therefore, on only attempting to illustrate the fisheries of a single district. In 1880, in preparing a similar exhibition for Berlin, he had selected the fisheries of Ningpo and the Chusan Archipelago for illustration. In the present year, in preparing a collection for London, he determined to break new ground, and to illustrate the fisheries of Swatow, and of its adjacent fishing ports, Tatapou and Haimên, and of the contiguous island of Namoa. Ningpo is in latitude 30° north; Swatow is situated just within the Tropics. To put the same thing in another way — Swatow is situated in the latitude of Calcutta and Havannah; Ningpo in the latitude of Suez and New Orleans. This difference would of itself produce an impression on the fisheries. But Ningpo is a much more important fishing centre than Swatow. The Chusan

Archipelago supports at least 10,000 fishing-boats, and at least 80,000 fishermen (Chinese Special Catalogue, Berlin, 1880, pp. 7, 10). It is roughly computed that Tatapou, Haiman, and Namoa contain 12,500 fishermen (Catalogue, p. 5).

In examining the Chinese collection, therefore, it is fair to recollect that it mainly represents only one district, and that not the most important district of China.* In Swatow (Special Catalogue, p. 1), as in Ningpo (Berlin Catalogue, p. 6), fishing is subject to no regulations. Each fishing-boat pays a license to the Government, but the payment constitutes the only restriction upon the fishermen. The most important fishery is the fishery for cuttle-fish, and 2743 piculs of cuttle-fish (nearly 170 tons), worth 53,880 taels, or about £15,000, were exported from Swatow in 1881. In the same year 3999 piculs, or about 240 tons of dried fish, worth, however, only 21,164 taels, or about £6000, were also exported. These figures do not lead to the conclusion that the export trade of fish in Swatow is of much importance.

The chief fishing grounds are situated about 18 miles from the Island of Namoa. The larger boats, sailing from Tatapou and Haimên, fish in pairs, drawing a long trawl-net between them. From Namoa the boats fish in companies—2 large boats followed by 45 smaller ones, forming a group or company; the large boats draw the net, and the small boats enclose a space around it, driving the fish into the net by splashing the water with bamboo poles.

Some of the fish are sold fresh in Swatow. There the boats fish only at moderate distances from the shore, and the fish, in wet, damp weather, can be brought in fresh as they are caught. This, however, is not the case in Ningpo, where the boats go 30 and 40 miles out to sea. For the purpose of supplying the fish markets at Ningpo, ice is sent out to the fishermen, and some 300 ice-houses have been built on the banks of the Yung River, between Ningpo and the sea. An excellent model of one of these ice-houses—all of which are built on the same principle—was at the Exhibition. "The construction of the ice-house is most simple. Stone walls, generally 20 feet high, covered on both sides with thick layers of mud, are built, and upon these rests a high straw roof. A flight of steps on one side leads up the wall to the entrance of the house, which is a doorway cut through the roof and covered with a straw curtain. Through the wall, on a line with the ground, a door is likewise cut, by which the ice is removed; gutters traverse the floor of the building to allow the water to escape. The ice is stored in alternate layers with straw mats. The fields round the ice-house are covered with water, and every morning during the cold season the ice, generally very thin, which may have formed during the night on these artificial ponds, is gathered and stored in the house. Fresh water is thereupon again pumped into the fields from the neighbouring streams or canals" (Special Catalogue, p. 48). In addition to the model of the ice-house, a model of the vessel, 65½ feet long by 13 feet beam, used in carrying the ice to the fishermen, was also at the Exhibition (*Ibid.* p. 45).

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* There are subsidiary collections from Ichang, Ningpo, and Takow. But the collection, as a whole, illustrates the Swatow district.

Though, however, some of the fish is sold fresh, most of it is either simply dried in the sun or salted. The first process is specially applied to the cuttle-fish, which are sun-dried, in hot weather, on the rocky islands near the fishing grounds. But much of the fish caught in China cannot be preserved by this simple process, and some of it is salted. Models of the pans in which the sea-water is evaporated, and the salt obtained from it, were at the Exhibition (Special Catalogue, p. 24). The process of evaporation is carefully explained by the editor of the Catalogue (*Ibid.* p. 11).

Inland fishing is also copiously illustrated at the Exhibition. Here, as elsewhere, are seen the fixed engines and other contrivances, only slightly differing from those which are used by fishermen in every other part of the world. There are, however, three objects in this department to which special allusion may be made. The first are the fine silk nets, made from the cocoons of the wild silkworm, which are some of the most interesting and lightest nets exhibited at South Kensington. The nets are soaked in wood-oil before they are used; and this process increases their strength, and diminishes their visibility (Special Catalogue, p. 15). The second object was the large boat prepared for cormorant fishing (*Ibid.* p. 46). I believe that this boat was the same boat which was exhibited at Berlin; and, I imagine, that to make the representation exact, hempen rings should have been placed round the necks of the cormorants to prevent them swallowing the fish which they caught. The third object is the singular boat used for night fishing on moonlight nights. "All along one side of the boat is a board about 1 foot wide projecting like a shelf, but sloping a little towards the water, and along the other side a net is erected perpendicularly. The board or shelf is painted white. Fishermen go out in these boats on bright clear nights, and the fish, attracted by the light of the moon falling on the board, leap upon or over it into the boat and are captured. The net prevents them leaping into the water or the other side of the boat" (Special Catalogue, p. 45). These boats, known as slipper boats, fish in pairs in Swatow (Special Catalogue, pp. 9 & 20), and singly in Ningpo. It is, perhaps, worth observing that the same expedient is used in Chittagong, a model of the precisely similar boat there used being in the Indian section of the Exhibition (*cf.* Dr. Day's 'Indian Fish and Fishing,' p. 50).

I have devoted some little space to a description of the Chinese section of the Exhibition, because it was characterised by a completeness which made it of special interest, and which reflects credit on the Chinese Government and on Sir Robert Hart, under whose direction it was arranged. But it must not be supposed that a study of the Chinese collections is likely to prove of much service to the practical fisherman. Fishing in China remains in a stationary state. "The modes of fishing, and implements used in the present day, vary little from those of the remote past: the simplicity of the former and the ingenious construction of the latter are as remarkable now as in days gone by" (Special Catalogue, p. 1). The Chinese vessels are still built on the old clumsy lines of the Chinese junk: they still carry the huge heavy rectangular sail, still made, not of cloth, but of matting; their foghorns are made of shells (Special Catalogue, p. 26), their lanterns of skin (*Ibid.* p. 27). Up to a certain period, no people in the world apparently made so great an advance in the art of fishing; and, for centuries past, no people have made so little further progress.*

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* The Chinese oyster fisheries were only sparingly illustrated at the Exhibition. It seems probable, however, that the heat of the water is favourable to the adhesion of the spat; which is found so generally on every shell, that "many Chinese assert that the spat is generated on the shell."—Sp. Cat. p. 59. The ingenuity of the Chinese is strikingly illustrated in the manufacture of Buddha images in mussel shells. A clay model of the image is placed in the shell; and the

TASMANIA.

It would be difficult to find a much greater contrast than that which exists between the circumstances of China and India, and those of Australasia. Two of the Australasian colonies—Tasmania and New South Wales—were represented at the Exhibition. Both of them, especially New South Wales, sent valuable collections to illustrate the marine fauna of the colonies; and the collections were especially instructive to anyone who had the advantage of having them explained to him by Mr. Ramsay, the Curator of the Museum at Sydney, and the Commissioner for both colonies at the Exhibition. Both collections had an interest of their own; that of Tasmania from the energetic and successful efforts which the colony has made to introduce fish of the salmon family into its waters. That of New South Wales from the extraordinary attention which the preservation of sea-fish is receiving in that colony.

There can be no doubt whatever that fresh-water trout have, for many years, been naturalised in the Tasmanian rivers; perhaps their introduction into these waters is the greatest and most important achievement of which fish culture can yet boast. The Tasmanians state with confidence that salmon have also been successfully reared there: smolts in large numbers annually descend to the sea; and large fish, believed to be salmon, are taken and sold in the markets. I have no reason for disbelieving the statements

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mussel covers it in time with nacre.—Sp. Cat. p. 49. Sir R. Hart asserts that the details of the process are kept a trade secret by those acquainted with it. But the secret must consist in the manner in which the clay base is first placed in the shell. Given it were so placed, any pearl-forming mussel or oyster would endeavour to cover it with nacre.

confidently made to this effect, though I think I am right in saying that no fish actually taken in the waters of the colony has yet been identified as a salmon by an English naturalist. The fish described as a salmon—*Salmo salar*—in the Tasmanian catalogue, and which was exhibited in London, was unquestionably not a salmon. Negative evidence of this kind, however, does not disprove the assertion made to a contrary effect in the colony; and I hope, therefore, that it may be assumed that salmon—as well as sea-trout and river-trout—have been successfully introduced into Tasmanian waters.

NEW SOUTH WALES.

In New South Wales, apprehensions have long existed that the sea fisheries are being over-fished and that sea fish are decreasing in numbers; in consequence, the Government of New South Wales has recently passed laws regulating the fishery. It is absurd for an Englishman with no knowledge of the colony to say that such laws are not necessary. But it is certain that, if they are necessary, fish must be either much less productive, or much more susceptible to the operations of man in Australasian than in English waters. The fishery of Sydney is only regularly conducted by two or three men, though many other men, when they happen to have nothing else to do, occupy themselves with fishing. The desultory fishing, which thus takes place, is conducted with hand-lines (some of which are imported into and some made in the colony), and by nets. According to the ideas held by most authorities in England, it is impossible for small operations of this character to make any impression on the stock of fish in the sea. It is, however, a remarkable fact that, when fishing was carried on in an equally desultory manner in England, the same apprehensions were freely entertained of the approaching exhaustion of the fisheries, and the same precautions were adopted by the British legislature to prevent their destruction as are now taken by the Government of New South Wales. The extension of the fishing, and the capture of fish by the ton load, first taught Englishmen to believe that the sea was practically inexhaustible. Possibly, when New South Wales becomes as populous as Britain, and the fishing operations become as large, the same conclusions may be embraced by its people.

A stranger, indeed, ignorant of the colony, and with only an European acquaintance with fishing matters, would be inclined to conclude that the fisheries of Australia were in more need of development than restriction. Large shoals of mackerel annually visit the waters of New South Wales, and these shoals are practically unfished. There does not seem to be any clear reason why a large and profitable fishery should not take place for them: and the Commissioners of Fisheries for New South Wales would, I think, do well to carefully examine the modes of fishing for these fish practised in American and British waters. The smacks now used for fishing—both in Tasmania and New South Wales—models of which were exhibited in London—are perhaps better adapted for carrying the drift-nets used by English fishermen than the purse-seines in use in the United States. Hitherto, indeed, the absence of an adequate demand has probably prevented the thorough working of the fisheries. But there does not seem to be any reason why the demand should not in future be large. The Commissioners for New South Wales exhibited an elaborate collection of tinned fish, "many varieties" of which were "peculiar to the Australian colonies," and, in consequence, attracted the special attention of the Jurors. It is legitimate to hope that the experiment which has thus been tried, may lead to the development of a new industry, and that the inhabitants of Australia, who have of course an especial knowledge of the art of preserving meat in tins, may apply the experience which they have thus acquired to the fish trade.

There are only one or two other matters to which it may be necessary to allude in connection with the exhibits of New South Wales and Tasmania. 1. New South Wales, in addition to an excellent collection of fish, sponges, and marine algæ, exhibited interesting samples of oysters, the produce of colonial oyster-beds. Judging from an inspection of their shells, the fish hardly bears the proportion to the shell which ought to be the case with a well-fed palatable oyster; and the oysters could probably be improved for the market if they were laid down—as brood—on suitable beds in semi-brackish water. 2. New South Wales also exhibited some stuffed specimens of Australian seal from the Seal Rocks near Port Stephens. I am assured by Mr. Ramsay that these seals have been so nearly destroyed that the authorities of the colony have thought proper to prohibit their slaughter. The seals were killed in thousands for the sake of their skins, each seal being worth about £10. However necessary it may be, to regulate the destruction of any animal, its utility, and consequently the apparent reason for its preservation, is destroyed by a policy of this character. If seals are not to be killed, and are to be of no service to man, there is no clear reason why man should preserve them. 3. It has not, I believe, been hitherto found necessary to extend a similar protection to the dugong, which is caught on the entire coast-line of New South Wales.

Stuffed specimens of this curious animal, and specimens of its hide, flesh, and oil, as well as of the sea-grass on which it feeds, were at the Exhibition (Catalogue, p. 180). It may be interesting to add that this animal, which has played a part in fable, is also taken off the coasts of Ceylon (*Ibid.* p. 167).

RUSSIA.

It is no easy matter for an Englishman to give an intelligible account of the fisheries of the Russian Empire: the excellent collections in the Russian Court seemed strange to an English eye; and perhaps, in consequence, only attracted imperfect attention. I rely, however, on a little pamphlet on Russian fishing and hunting by Dr. O. Grimm; on my own inspection of the exhibits; and on the explanations courteously afforded to me by M. Charles Schœneich, the General Superintendent of the Section.

Russia has, of course, a smaller seaboard than any great country in the world. Her northern shores are indeed washed by the Arctic Ocean. But a frozen sea affords only few opportunities to fishermen, and the only other outlets which Russia possesses to the ocean are through the waters of the Baltic and of the Euxine. These two seas, both of which receive more fresh water from the great rivers which flow into them than they lose from evaporation, are remarkable for the freshness of their waters. This circumstance is supposed to account for the poverty of their fauna. These are few in number, and, of their kind, small in size. What, in one sense however, is much more remarkable, is that several of the fishes of the Euxine are identical, or nearly identical, with those of the Arctic Ocean; and this circumstance affords a strong presumption that, in a period which geologists do not consider remote, the waters of the Black Sea and of the Arctic Ocean were connected one with another.

Geologists presume that, at a period possibly subsequent to the origin of man, the present outlet of the Euxine through the Bosphorus was closed, and that its waters flowed eastwards, through the Sea of Azov, into a great mediterranean sea in Central Asia, the basin of which is still marked by the depression whose deepest points are filled by the Caspian and the Sea of Aral. If the waters of the Euxine were raised only 23 feet above their present level, they would actually now find their way into the Caspian through the valley of the Manytsch. If they were raised 158 feet, they would find their way into the Sea of Aral; if they were raised 220 feet, the great mediterranean sea which would then be formed would discharge its waters through the Tobol, one of the tributaries of the Obi, into the Arctic Ocean. Horizontal land-marks show that time was when the waters attained this level, and it is therefore almost certain that there was a period in the world's history when a great Asiatic Mediterranean stretched from the Euxine to the Polar Sea.*

The diversion of the waters of the Euxine from the Asiatic Mediterranean has had the effect of reducing the level of the waters of the Caspian. Vast as is the area drained by the Volga, and the other great rivers which flow into the inland sea, the waters which they bring down are not sufficient—or were not sufficient—to compensate for the loss by evaporation. As the waters of the sea receded, vast land-locked bays were formed at certain parts at its sides, and these, being extremely shallow, and exposed to the full force of a hot summer sun, became large natural salt-pans. At the present time one of these great shallow lakes—Lake Karaboogaz—is perpetually fed by the waters of the Caspian. As a result, the salt, which would otherwise be in the Caspian, is abstracted from it in large quantities,* and the waters of the Caspian are in some parts so fresh as to be almost potable. Lake Karaboogaz is only an illustration of what, in a previous period, occurred in other lakes adjoining the Caspian. Two lakes alone are estimated to contain a supply of 907,000,000 tons of salt. 443,238 tons of salt were procured from the lakes in 1882; and of this large amount one-eighth, or 54,809 tons, were used in curing fish. (A map of the salt lakes, and samples of the salt, were exhibited in London. *Cf.* also Grimm, pp. 36, 37.)

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* These facts will be found in an interesting article on the Caspian, by Dr. Carpenter, in the last edition of the 'Encyclopædia Britannica.'

The Russian fishermen, therefore, possess in abundance the salt, a want of which is interfering with the development of the Indian fisheries; and the presence of the salt has undoubtedly led to a great increase in the fishing industries in Russia, and especially in the Caspian.

Dr. Grimm, in the publication which I have already quoted, shows that the fisheries of the Caspian basin produce 28,000,000 poods (or 400,000 tons) of fish a year: he estimates the value at 35,000,000 roubles, or £3,500,000. He estimates the produce of the fisheries of the Sea of Azov at 6,000,000 poods; of the Black Sea at 100,000 roubles; and of all the other Russian lakes and rivers at 7,000,000 poods. The total produce of the Russian waters cannot therefore be much less than 42,000,000 poods (600,000 tons) of fish a year. If the value of the other fisheries corresponds with those of the Caspian, the value of the Russian fisheries cannot be worth less than £5,250,000.

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* Dr. Grimm says that Lake Karaboogaz abstracts 32,000,000 poods of salt, or nearly 500,000 tons of salt a day. The amount is stated by Dr. Carpenter as 350,000 tons.

If these figures be even approximately correct, the fisheries of Russia produce more food than those of any other country in the world; they produce more money than those of any other country in the world except the British Islands and the United States; and no surprise need therefore be felt at the evident pains taken by the Government of Russia to secure an effectual representation of their fisheries in the International Fisheries Exhibition.

The sturgeon, the most important of Russian fish, which practically supplies the whole world with caviare, yields 8,000,000 roubles (£800,000) annually to the Russian fishermen. The flesh of the fish is worth £500,000; the caviare, £225,000; the isinglass, &c., £70,000. But, in addition to this vast take, 250,000,000 herrings, 350,000,000 roach, 300,000,000 "taran"—a term which I believe is promiscuously given to bream, bleak, and other fish—26,000,000 soodak (the lucioperca) are taken in the Caspian and swell the profits of the Russian fishermen.

Vast, however, as the capture of fish in Russia is, the amount taken is not sufficient for the people. Dr. Grimm states that Russia annually imports some 5,000,000 poods of fish, worth £700,000. She exports, on the contrary, only 300,000 poods of fish, worth, however, as it consists chiefly of caviare, the large sum of £280,000. In point of value, therefore, the import exceeds the export by £420,000; in point of weight it exceeds it by 4,700,000 poods. It may therefore be assumed that upwards of 46,000,000 poods of fish, of the value of £5,700,000, are annually consumed in Russia.

One of the most prominent objects in the Russian Section was the great draft-net which is used on the Volga, and which is 3000 feet long. A picture of it being worked by 21 men was also in the Section. In addition to this net many other kinds of nets were exhibited—trammels, hoop-nets, &c., while wooden traps, used for the capture of lampreys, and a weir in use in the Volga, were also shown. But perhaps more interest attached to the illustration of the fishing in the Volga when the river is frozen over. Then a vast number of men is employed in breaking holes in the ice with poles armed with iron, while other men draw the sturgeon, which probably come to the holes to breathe, through the ice with large gaffs. The representation of this mode of fishing, however, and other things in the Russian Court, produced an impression that labour was very cheap, and expedients for saving it very rare, in Russia. In a country where the fisheries produce millions annually, where nets are used 3000 feet in length, all the nets are hand-made. When the winter fishery commences in the frozen Volga, the men of the village are summoned by cannon-shot to take part in it. Fishing under such circumstances becomes almost a military operation, and the visitor to the Section concludes that, if Russia derives more profit from fishing than any country in the world except the United Sates and the United Kingdom, she expends more labour than any other country in the world in capturing the fish which she takes.

There were one or two other objects in the Russian Section to which it may be desirable to allude. Russian exhibitors showed "many varieties and preparations" of cured fish "little known in other countries. Some excellent exhibits of caviare were specially noticeable." There was also a model of the piscicultural establishment at Nikolsky, which was opened in 1855 by M. Vrassky, and which since 1869 has been carried on by the Russian Government under the charge successively of M. Repinsky and Dr. Grimm (Dr. Grimm's pamphlet, pp. 40, 41). M. Vlassoff also exhibited a model of a steam-vessel used for carrying fish alive on the Volga from Astrakhan to St. Petersburg, which very properly attracted marked notice from the Jury; and M. Hoth showed some specimens, arranged as a trophy, of the ropes and lines which he is manufacturing at the latter town. A model of a Russian fish-shop, erected on one of the St. Petersburg canals, was also worth examination. I am informed that there are twenty-one of these shops in St. Petersburg.

GREECE.

The fisheries of Greece are not so important as those of Russia. They are however marked by characteristics of their own. Several of them are described in a little pamphlet, 'La Pêche en Grèce,' published by M. Apostolides during the present year; and a brief account of what is going on in Greece may be interesting here.

The chief fisheries in Greece, using the word in its proper sense, are the fisheries for the tunny, for the sardine, and for the mullet. The sardine fishery takes place in Corinth, Chalcis, and Oræoi. It only lasts during the summer months, but it affords employment, while it lasts, directly and indirectly, to 1500 persons. The fish are caught by a very fine seine-net; they are always salted; and these towns produce from a minimum of 1000 to a maximum of 5000 barrels of sardines every year. The salting is conducted in the simplest way. The fish are gutted, washed, and placed in the barrels, every layer of fish being alternated with a layer of salt (Apostolides, pp. 72, 73).

The tunny fishery has also some importance. It is conducted by the fishermen of Spezzia, in the Gulf of Argolis, and employs every year some 25 boats and 150 men, yielding about 10,500 francs, or £420 a year (Apostolides, p. 39; and Catalogue, p. 269). But the tunny fishery and sardine fishery are of less importance than the mullet fishery, which gives rise to an industry, peculiar, I believe, to Greece—the manufacture of boutargue.

Boutargue is "a caviare prepared from the roe of the mullet. The eggs are salted, crushed, reduced to a paste, and then dried in the sun. Sometimes spices or other ingredients are added. Boutargue is eaten, like caviare, as a *hors d'œuvre*, and is consumed in great quantities in Italy, Corsica, and the South of France" (Catalogue, p. 271). Large numbers of mullet have necessarily to be taken for the purpose. Most fishermen are aware, however, of the extreme difficulty of netting grey mullet, from the circumstance that the fish are apt to follow one another like a flock of sheep, to leap over the net and escape. To obviate this the Greeks have devised a very ingenious contrivance. They have attached to the head-rope of the seine some bamboos which support a wall of netting, against which the mullet leap. This device deserves the attention of persons who are interested in fishing for such fish as grey mullet and bass.

In addition to these fisheries, the Greek Government let out certain portions of the foreshore, for the purpose of what M. Apostolides calls water-culture, and what the Catalogue calls pisciculture (Apostolides, p. 74; Catalogue, p. 269), but in reality for the capture of fish. "The best of these establishments, of which there are 84* in Greece, are installed in the lagoons, which extend over a space of more than 30 square kilomètres in front of the town of Missolonghi. Two-thirds of the population of the town earn their living by fishing, and, above all, by a kind of pisciculture—that is, retaining the fish in the lower lakes by an enclosure, and afterwards capturing them just at the moment when, eager to spawn, they seek to regain the open sea" (Catalogue, p. 269). These establishments are let by the Government by public auction once in every ten years; they at present yield a revenue of 3,000,000 francs (£120,000) a year (Apostolides, 66 and 76).

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* The Catalogue says 24. But M. Apostolides gives a list of 84, and I have accordingly inserted this number in the text. The passage in inverted commas is otherwise abstracted from the Catalogue.

There are one or two other points connected with the fishery which it may be worth while to mention. There is no manufactory for nets in Greece. The nets are handmade; but the thread and string of which they are made is manufactured at Syra, Poros, Chalcis, and Hydra. Cotton, grown in Greece, silk, flax, and hemp are all used; while, as I have already mentioned, lines are made both of goats'-hair and horsehair. The Greeks use long lines armed with about 400 hooks, the hooks being two feet apart. Instead of a buoy, they fasten to the end of the line a small bamboo triangle, on which, or rather above which, a bell is suspended.* The motion of the waves rings the bell, and the ringing of the bell enables the fisherman to find the end of his line on the darkest night, and thus facilitates his labour.

But the most important fishery on which the Greeks are engaged is the sponge fishery, if the term fishery may rightly be applied to the capture of the sponge. Greece supports 1695 fishing-boats, measuring 5740 tons, and employing 6064 men (Apostolides, 85). But, of these, 723 boats and 3100 men are engaged in the sponge fishery. The Greeks, or rather the fishermen of five Greek places and ports, Egina, Hydra, Kranidi, Hermione, and Trikéri, practically enjoy a monopoly of the industry; and Western Europe derives its chief supply of sponges from Greek fishermen. The sponges are found in the Ægean, off the coast of Crete, and off the coasts of Tunis and Tripoli. The finest sponges are found in Greek waters. Crete, Cyprus, and Tripoli, however, all produce sponges of a high quality. The sponge of Tunis is inferior to these, but finds a ready market in France (Apostolides, p. 80).

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* A similar device is used in Spain.

The fishery usually commences in April. The boats, which fish on the coast of Africa, engage a vessel to carry them to the fishing grounds, and, when the fishery is concluded, to return for them and their produce. On the ground the boats fish in pairs; and the expenses of each pair of boats during the four months for which the fishery lasts are about £80. It may be assumed, therefore, that the expenses of all the boats engaged in the fishery amount to about £30,000. The produce of the fishery was estimated in 1882 at £96,000 (Apostolides, pp. 79, 81); so that sponge fishing constitutes a profitable calling.

Sponges are taken in three ways: (1st) by the harpoon, (2nd) by divers in a diving dress, (3rd) by divers. When the sponge is brought up "it is covered with a soft gelatinous substance, as black as tar, and full of organic life," the sponge of commerce "being only the skeleton of the organism."* Every evening, when the fishery is over, the black matter is either scraped off the sponge, or pressed out of it by being trampled under foot, and the sponges, threaded by a string, are subsequently left all night in the water. The process is continued on the following evening, or till all traces of the organism have disappeared. When this is accomplished, the sponges are left in the air to dry.

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* The extract in the text is from an official introduction to Bahamas Fisheries, pp. 4, 5. M. Apostolide's words are very similar: "Les éponges sorties de la mer ne sont pas en état d'être livrées au commerce. Elles ont encore la matière protoplasmique qui les enveloppe" (p. 79).

The finest sponges are taken in the clear waters of Greece either with the spear or by the diver. The fisherman in the diving-dress can only fish in particular places, and catches only the coarser and cheaper sponges.

THE BAHAMAS.

It may, at first sight, seem strange to connect the fisheries of the Bahamas with those of Greece. I do so because the population of the Bahamas, like the Greeks, derive a considerable profit from a sponge fishery. Except, indeed, for the sponge fishery, the Bahamas would hardly be entitled to a place in the Exhibition. For, though fish are caught off the coasts of the islands, and are sold in Nassau for food, their total value does not exceed £8000 a year. A small export trade exists in pearls, shells, ambergris and turtle; but the whole of the trade only represents an annual value of £5800. On the other hand, sponges to the value of £60,000 were exported in 1881.

The existence of the sponge in the waters of the Bahamas was discovered by the late Sir John Lees. The men engaged in the sponge fishery employ fine schooner-rigged vessels, a model of one of which was at the Exhibition, which are built in the colony, ranging from 15 to 60 tons, and which carry from 6 to 12 men. The fishery is conducted in much the same way as that of Greece. The fishermen coast along the shallow reefs which fringe the Bahamas, and either by hooks or by diving pull up the sponges, which are easily seen in the clear water. The sponges are spread on the deck of the vessel in order that the organic matter, in which they are involved, may be killed by the sun's rays. When dried it is beaten out with sticks and washed away with the action of the tide. The sponges are then strung on small palmetto strips, and sold in Nassau. The subsequent operations are conducted not, as in Greece, by the fishermen, but by the sponge merchant. This trader soaks the sponges which he has bought in lime water, and subsequently dries them in the sun. "They are then pressed by machinery into bales, containing 100 lbs., and are then sold in England or the United States, which of late years is almost the largest customer for Bahama sponges"* (Bahamas Fisheries, p. 5).

ITALY.

The Bahama Section contained a small but carefully selected exhibit of the sponges and other articles produced by the Bahama fishermen, as well as of the boats and instruments used in fishing. I regret that I cannot extend similar praise to the Court which I now proceed to consider: viz., that of Italy. With one important exception, the exhibit of Signor Criscuolo, to which I shall allude in detail, this section only contained the finished produce of Italian artificers in coral, shells, and other articles. Beautiful as many of these objects were, they had, of course, no practical importance. The Italian section of the Catalogue, however, was preceded by an excellent account of the Italian fisheries from the pen of Professor Giglioli, of the Royal Zoological Museum at Florence, and I am thus enabled to give some account of the fisheries of Italy.

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* A sponge fishery of some importance also exists on the coast of Florida, and yields the United States fishermen some $200,000 a year. An account of this industry will be found in Mr. Brown Goode's 'Fisheries of the United States,' p. 53. In Florida, as in the Bahamas, the sheep's-wool sponge is regarded as the choicest variety I have during the last few weeks constantly used one of these sponges, which is certainly superior, in all the essential requisites of a sponge, to the ordinary bath sponge of the Tunisian coast.

Professor Giglioli states that in 1869, excluding the then Papal States, Italy is supposed to have supported 60,000 fishermen, who worked 18,000 boats, and produced 40,000,000 of lire, or £1,600,000 a year. He adds that in 1878 the fishery exports amounted to 39,887 kilogrammes, worth 3,259,670 lire; while the imports in the same year weighed 44,060,300 kilogrammes, worth 21,479,740 lire. The imports therefore exceeded the exports in weight more than a thousandfold; they exceeded them in value less than seven times. This striking difference is, of course, due to the fact that the exports consisted chiefly of the costliest corals, &c., while the imports were mainly made up of salt fish, much of which was of the cheapest character. The Italian fisheries, in other words, fail to supply the demand for fish among the Italians. The result is partly due to natural causes. The Italian seas are peculiarly rich in marine fauna; but they are not equally rich in food fish.

The tunny fishery is the most important fishery which the Italians possess. There are 39 tonnare—or large fixed nets—in Italy, in which the tunny is caught. The tonnare in Sicily alone employ 1400 men; those of Sardinia, 1000 men: "The entire produce of the fishery was valued ten years ago at about 7,000,000 lire (£280,000) annually."

The other fisheries of importance are (1) the sword-fish fishery; (2) the sardine and anchovy fishery—600,000 kilogrammes of sardines, worth 200,000 francs (£8000), and 400,000 kilogrammes of anchovies, worth 400,000 francs, (£16,000), are taken at Palermo alone; (3) the hake fishery; (4) the whitebait fishery. Italian whitebait are the young of the sardine and of the anchovy; and Professor Giglioli thinks that their capture "is certainly detrimental to fishery interests, and ought to be stopped or restricted as much as possible," an opinion which is opposed to the conclusions of authorities in this country on a similar subject.

In addition to the fisheries which have already been mentioned, the lagoons which are frequently found near the mouths of Italian rivers, and elsewhere on the Italian coasts, support mullet fisheries and eel fisheries. Mullet, as every traveller knows, is one of the commonest of Italian fishes; they are taken in fixed nets in these lagoons. It is interesting, in connection with the eel fishery, to observe that the Italian lagoons also support a fishery for "ceche," elvers, or young eels. I know of no other fishery of this kind, except that which is conducted every spring in the Bristol Channel.

These, however, and other matters were not illustrated in the Italian Section. The beautiful preparations in wax of the anatomy of various kinds of fish, as well as the excellent collection of fish preserved in spirits, which formed prominent objects in the Italian Section at Berlin, were not sent to London; and, from a practical point of view, the interest in the Italian Section consisted in the excellent exhibit of Signor Criscuolo, to illustrate—if I may again use a popular misnomer—the coral fishery.

Coral is found in various parts of the Mediterranean. It grows on a rocky bottom in water from about 25 to 100 fathoms deep. But the beds are apparently capable of easy exhaustion from the operations of the fishermen. In 1871, 359 boats, employing 3623 persons, were engaged in the fishery, and were rewarded by obtaining 5,000,000 lire (£200,000) worth of coral. In 1875 the discovery of the Sciacca banks on the south coast of Sicily gave a fresh stimulus to the industry. The produce of these banks alone yielded coral worth 4,498,000 lire, and afforded employment in 1882 to 582 boats and 5766 men. These banks, however, have in their turn been fished out, and the fishermen during the present year are engaged in working a fresh bank, only discovered in 1880, in the same neighbourhood. They expect to derive much coral from the bank, but the coral upon it is mostly dead, and of inferior quality and value.

Coral is caught in the following manner. Two large and heavy pieces of timber, 6 or 7 feet long, are lashed together in a St. Andrew's cross, and heavily weighted with stones. To each limb of the cross 10 or 12 rough nets made of the fibre of the cannapa, a plant which grows near Naples, are attached. Armed with these nets, the cross is let down to the rocky bottom of the sea. It is pulled up from the bottom along the surface of the rock by a large wooden windlass placed amidships, and worked by hand; and the cannapa, catching in the coral, tears it from the rock, and brings it to the surface. An operation of this kind necessarily involves heavy labour, and the coral boats are accordingly strongly manned. Each boat carries a crew of eleven men. The captain steers the vessel and supervises the operations generally. The four oldest men are placed at the oars; and the six youngest men of the crew at the windlass. As the labour lasts from early morning to late evening, and is conducted under an Italian sun, the process is necessarily a very exhausting one.

The coral fisherman has no interest in the proceeds of the fishery. He is paid a fixed salary, 800 francs in the case of the crew, and 1000 francs in the case of the captain; and the whole proceeds of the fishery go to their employer. Signor Criscuolo does not only employ boats to fish for coral—he has a factory in Naples for preparing it for sale. The whole process of manufacture, as well as of fishing, was illustrated at his exhibit, and a really excellent idea was thus obtainable of an important Italian industry.

SPAIN.

To a certain extent there is a close resemblance between the fisheries of Spain and those of Italy. Spain, of course, has a seaboard on the Atlantic and a seaboard on the Mediterranean. On the latter the fisheries are naturally similar to those of Italy; on the former the fisheries attain an importance of which few Englishmen have any idea. In the Mediterranean the tunny is the principal fish taken; in Galicia and in the north-west of Spain the sardine is the chief source of profit to the fishermen.

Before attempting to describe these fisheries, it is due to the Spanish Government to say a few words upon the character of the Spanish exhibit. With rare exceptions, no nation took so much trouble as Spain to make her exhibit comprehensive. The Spanish Government sent a vessel to all the principal ports, collected objects of interest, carried them free to London, and undertook to return them without expense to their owners. With rare self-denial, moreover, Spain refrained from sending to London any articles except those of practical importance. I had the advantage of having many of these objects explained to me by Captain Comerma, one of the Spanish Commissioners, and I may consequently hope to be able to give a fairly intelligible account of fisheries which are of unquestionable importance.

"The fishery products on the coast of Spain for the year

1882 are estimated at 79,540,165 kilogrammes, the number of men employed was 59,974, and of boats 14,202, with a tonnage of 51,397" (Catalogue, p. 343); 533,665 kilogrammes of fresh fish, worth 106,733 pesetas; 545,021 kilogrammes of pickled fish, worth 218,011 pesetas; 63,918 kilogrammes of cured fish, worth 51,134 pesetas; 3,300,064 kilogrammes of sardines, worth 1,650,034 pesetas; and 167,653 kilogrammes of shell-fish, worth 50,296 pesetas, were exported. A gross total of 4,610,331 kilogrammes, worth 2,076,208 pesetas, were, therefore, exported, and 74,930,000 kilogrammes of fish were retained for home use. If the value of the fish so retained corresponded with that which was sent away, fish worth at least 36,000,000 pesetas, or about £1,400,000, must have been taken off the coasts of Spain. If this estimate be at all accurate—and it is difficult to see how it can be wrong—the 60,000 fishermen of Spain can only earn £23 each. As the Spanish fishermen have no other interest than fishing to depend upon, and as a large amount of capital is invested in the fishery, it is an almost inevitable inference that the fishing community must be very poor. It would indeed be unfair to compare the earnings of a labouring class in a country like Spain with those of a similar class in a country like Great Britain. But the poverty of the Spanish fishermen will perhaps be appreciated if their earnings be compared with those which I have already cited for Italy. Both countries support, in round numbers, 60,000 fishermen. These men work in Italy 18,000 and in Spain 14,000 boats; in Italy the 60,000 men earn £1,600,000; in Spain they apparently only earn £1,400,000.*

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* It must be recollected, moreover, that these figures represent the value of much of the fish after it is cured, a very different thing from the value of the fish when it is taken.

The two chief fisheries of Spain are: (1) that for the tunny, and (2) that for the sardine. The former is taken in the Mediterranean, the latter on the north and north-west coasts. Throughout the Mediterranean, the coasts of Italy, of Spain, and of Africa, the tunny is taken in the large fixed net, which is called the *tonnara* in Italy, and which is known as the *almadraba* in Spain. I am told by Captain Comerma that the *almadraba* is sometimes 800 fathoms in length, or nearly a mile long, and that as much as £6000 is embarked in one of these fisheries. But the most important fishery in Spain is that on the north and north-west coasts for the sardine. Sardines and anchovies, for both fish are taken on the Spanish coast, are caught in two ways: 1. By a modification of what an Englishman would call a purse-seine; (2) by a drift-net. In the first process the seine is shot round the shoal of fish; the bottom of the net is drawn together, the bottom rope running through rings for the purpose, and the fish are thus enclosed in a purse from which they can be taken at leisure. In Corunna the *cerco reale*, a still larger net, constructed on the same principle, is used for the purpose. The net however, when it is paid out, is secured by anchors to the bottom of the sea, and is left stationary for days, or until the captured fish are required for the market. Captain Comerma tells me that these nets are frequently 1000 fathoms, or considerably more than a mile long; 18 fathoms, or 108 feet, deep; that they employ directly or indirectly 150 men;* and that they take from 10 to 14 hours to set.

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* Captain Comerma says "the number of men required to work the cercho net is about 150 persons, which includes the transport, and 50 men for manipulating the nets only, and managing the boats." The statement is so remarkable that, in repeating it here, it seems desirable to be precise.

It will be easily understood that netting conducted on this vast scale indicates a considerable fishery. I am informed that in Galicia alone 600 factories have been established for salting or curing sardines. The factories represent a capital of half a million; the nets are worth £220,000, and they afford employment to 20,000 persons on shore, and 30,000 fishermen afloat; 460 tons of fish have before now been caught at one time in one net—a catch sufficient to load fifty lighters.

Sardines are also caught by drifting; but there is a peculiarity about drifting for sardines which deserves mention. The fish are tempted to rush into the nets by cod-roe scattered in the sea on either side of the wall of netting. This circumstance has given rise to a profitable industry both in Norway and America; and from each of these countries large quantities of the roe of cod are exported both to Spain and France as bait for the sardine fishery. It may be of interest to some persons if I add that, while the roe of cod is used in Spain for the capture of the sardine, the sardine itself is used as bait for the cod.

The mention of cod brings me naturally to another industry, in which the Spanish fishermen are engaged. Cod are caught with lines in the north of Spain; but cod are also caught in the neighbourhood of the Canary Islands. The fishery in the latter place is remarkable; in the first place, it is, as far as I know, the most southern locality in which cod are caught; and, in the next place, it is the almost solitary remnant of the enterprise of Spanish fishermen in repairing to distant waters to fish. "In the reign of Philip II. two hundred vessels, with no less than 6000 sailors, left the Cantabrian shore for the cod fisheries of Newfoundland." But "these fisheries have been constantly declining and have ceased altogether." (Catalogue,

p. 342.)* With the solitary exception of the Canary Islands, which are fished by the vessels of a company, Spanish fishermen remain in their own waters and catch their own fish. The records of the past, however, and the existence of this company prove that the Spaniards, under a settled Government, are capable of better things, and point to a possible development of the Spanish fishery. Probably the government could not do better than encourage by all legitimate means, such as the repeal of any injurious taxation, the development of the fishery. The Spanish, however, seem to have arrived at a different conclusion, and consider that the fishery is more in need of restriction than development. I have already alluded in the beginning of this Report to the curious trawl-net in use in China, in Germany, in Spain, and in France, which the Spaniards call a *bou*, and the French a *chalut*. The observation which an English critic is tempted to make on the net is, that English fishermen with a beam-trawl are able to do the work at least as efficiently with only one boat, for which the Spanish fishermen employ two boats. The reflection which Spanish authorities make on the net is that its use is disastrous. The Spanish Government is actually invited to prohibit the use of the *bou*, and this source of profit may in consequence in a few years be lost to the Spanish fishermen. I am far from venturing to assert that the advisers of the Spanish Government are wrong. It is the height of presumption for a foreigner, unacquainted at first hand with the facts, to criticise the policy of a foreign State. But I do assert that the arguments which Lieut.-Col. Garcia Solá uses against the *bou* ('Basis for Legislation for Fishing Questions,' p. 8) are precisely similar to those which in this country are urged against the use of the beam-trawl; and it is difficult, therefore, to see how, if England be right in permitting the beam-trawl, Spain can be also right to prohibit the *bou*.

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* If Mr. Froude be right, the statement in the Catalogue is well within the market. He relates in his history that a serious proposal was made to Elizabeth by a nameless projector, whom he suspects was Drake, to fit out an expedition to Newfoundland to capture or burn the Newfoundland fishing fleet. "Commit us afterwards," said the writer, "as pirates if you will, but I shall ruin their sea forces, for they depend on their fishermen for their navies." "The Newfoundland fleets," adds Mr. Froude, "contained 25,000 innocent industrious men, all of whom were obviously meant to be destroyed." Some of the vessels belonged to France and Portugal. But considerably more than 6000 men, if Mr. Froude be accurate, must have been Spaniards. —See Froude's Hist. of England, x. 422.

There are only one or two other matters in the Spanish Court which it seems necessary to mention. The Spanish Government exhibited a boat so constructed as to enable a strong light to be let down through the hull, so as, if I may quote a popular line, to "illumine the depths of the sea." The fish, attracted by the light, come to the boat, and thus fall an easy prey to the fishermen. The Spanish Government also showed an excellent collection of net and ropes, some of which were made at the Royal Dockyard at Carthagena, and others by private makers at Barcelona and elsewhere. It seems from this collection, and from what I learned from Captain Comerma, that the Spanish fishermen prefer flax to cotton-nets in the sardine fishery. They think that the flax is less visible, and therefore more deadly, than the cotton. The flax-nets shown were of a superior quality, and afforded clear proof that the Spanish fishermen, poor as they seem to be, do not grudge the purchase of a net, which is, of course, presumably more expensive than a cotton-net. By an odd contrast, while their nets are made of a comparatively costly material, the ropes are frequently made of one of the cheapest of fibrous vegetables, esparto grass. No one who has not carefully examined the Spanish collection can have any idea of the extent to which esparto grass—used in England for the manufacture of paper—is employed in Spain. The ropes made of this material are both lighter, and 50 per cent. cheaper, than those manufactured of hemp. If, however, they gain both in lightness and cheapness, they are deficient in strength; and it is not, therefore, probable that they could be introduced with advantage into this country.

It would be unfair to conclude this account of the Spanish fisheries without mentioning the circumstance that the most remarkable evidence of their development was in the British, and not in the Spanish section. Two models were exhibited in the British Sea Fisheries Gallery of steamers, built at Granton, for trawling on the Spanish coast, which have been successfully working there for some time. These models were certainly equal, and probably superior, to any models of steamers actually used for fishing in any portion of the world; and it is impossible to avoid a feeling of surprise that the country capable of displaying its enterprise by purchasing vessels of this character, should have so little regard for the value of labour as to employ 60,000 fishermen in catching fish, which are certainly not worth more, and which are probably worth less, than £1,400,000.

PORTUGAL.

I should be glad, if it were possible, to supplement this account of the fisheries of Spain with an intelligible account of the fisheries of Portugal. Unfortunately, the Exhibition afforded no materials for doing anything of the kind. Portugal had, it may almost be said, no exhibit—it had no exhibit to illustrate the fisheries of the country; and, though many details were given in the Official Catalogue about the Portuguese fisheries, it is not easy for a stranger to found any generalisation, which would either be useful or accurate, upon them. There is ample evidence, however, that in Portugal, as in Spain, many thousands of persons are wholly or partly dependent on fishing; there is, unfortunately, also evidence that the Portuguese, like the Spaniards, derive a miserably small return from their industry. In the township of Peniche, for instance, 1550 men are employed in fishing for sardines, whiting, and other fish. The approximate value of the fish they take is placed at 37,000 milreis. One thousand persons find regular employment in fishing from the townships of Villa Real, Alcoitim and Martola. I infer from the Catalogue that the produce of the fishery in 1877, the only year given, was worth 27,000 milreis (Catalogue, pp. 331, 335). It seems to follow that in these two districts upwards of 2500 men are engaged in catching fish worth 64,000 milreis (about £14,400). If the produce of the other fisheries of Portugal are only relatively equal to that of these two districts, the Portuguese are unquestionably expending a comparatively large amount of labour on the capture of a comparatively small amount of fish.

It would probably, therefore, be found, if it were possible to write an intelligible account of the condition of the Portuguese fisheries, that they are marked by the same characteristics as those of Spain; and, however interesting such an account would be, it would not prove of much service to communities whose fisheries are in a more advanced state. Economy of labour in fishing is just as necessary as economy of labour in other pursuits; and economy in labour has not yet been effected in any of the countries whose fisheries I have hitherto reviewed.

AMERICA.

I now come, however, to one of the most important divisions of the Exhibition, which is marked by very different characteristics—the division which comprises the exhibits of the North American continent. These fisheries were represented at the Exhibition by the important collections from the United States, from Canada, and from Newfoundland.

In systematic arrangement, in interest, and as a fishery school, the collections from the United States ought probably to have precedence over the exhibits of all other countries; just as in point of value the fisheries of the States must have precedence of all others, except, perhaps, those of the British Islands. The fisheries of Canada, from a commercial standpoint, rank between those of the States and those of Newfoundland. The fisheries of Newfoundland, valuable and important as they are, rank, as a whole, below both those of the States and of Canada.

NEWFOUNDLAND.

From another point of view, however, Newfoundland enjoys a singular pre-eminence. In proportion to its population, it contains more fishermen, and produces more fish than any other country in the world. The population of the colony and of the adjacent coast of Labrador, which is attached to it, is placed by Mr. Hepple Hall at 190,000 persons. I am assured by Mr. Harrison Ridley, the Secretary to the Newfoundland Commission—to whom I am much indebted for information—that 52,000 men, women, and children are engaged in the fisheries of the colony.*

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* The number is stated in the Newfoundland Catalogue as 52,550, of whom 30,238 are described as able-bodied men.

The average annual value of the products of the fisheries during the last three years has amounted to £1,645,000. The fisheries, therefore, employ more than one person out of every four of the entire population, and yield about £9 of produce for every person living in the colony. No such conditions can be found in any other country in the world; and the exhibits from Newfoundland, in consequence, demand attentive study from all persons interested in fishing.

The Exhibition, it may be stated, afforded evidence that the fishermen enjoy a fair prosperity. A model of a fisherman's home occupied a prominent place in the Newfoundland court, and I am told that it afforded a fair representation of a Newfoundland fisherman's dwelling. It is built near the water's edge on the shore of one of the natural harbours with which the coast of Newfoundland is indented. The schooner, from which the man fishes, is moored alongside a landing-stage, which is used also for splitting and salting the cod. The fish, after being left in the salt for three weeks or a month, are placed on "flakes," or long sticks resting on timber uprights, where they are dried in the sun. The "flakes" are separated from each other so as to allow the air a free passage between them; and the fish are gradually dried, first in heaps, and afterwards singly. No agency, other than the sun and the air, is used in the process. It is evident from this description that the Newfoundland fisherman is not merely a fisherman, but also a manufacturer; and that the processes of curing, which in more advanced communities support a separate industry, are performed in Newfoundland to a great extent by the fishermen themselves.

The cod fishery, which is carried on by men who live in this way, forms far the most important of these industries.

The cold Arctic current which flows down the Newfoundland coast and, meeting the warm equatorial currents on the south-east of the island, produces the fogs for which Newfoundland is notorious, affords conditions exceptionally favourable for the support of cod in great quantities, and of a high quality. The fishermen who catch them all use schooner-rigged vessels. The smaller boats, or "Jacks" as they are called, fish from three to ten miles from the shore, and range from 10 to 15 tons burden. The western fishing schooners fish along the coasts, and range from 20 to 30 tons burden. The vessels which fish the banks are from 70 to 90 tons burden, and are also schooner-rigged. The schooner rig is, therefore, the rig universally in use in the Newfoundland fisheries. Models of the various schooners were exhibited in the Newfoundland court, and, in the opinion of the Jurors, reflected "much credit upon the Commission for arrangement and selection." The Jacks and western schooners are fitted with punts, the banks schooners with "dories." The Jack carries four to five men, the western boat seven to eight, the Banks schooner twenty hands. The fishing is entirely conducted with hand-lines, 20 fathoms long, with only one hook to each line. The lines have hitherto been imported from England, but a cordage factory has recently been built at St. John's, which exhibited "a small but very well-selected exhibit," and which secured a silver medal from the Jurors. The hooks are baited with herrings, capelin, and squid; and the capture of these fish, as bait, forms a subsidiary industry. In addition to this method of capture, cod used to be taken, and are still to some extent taken, by seine-nets. But the seine-nets are being gradually superseded by trap-nets. The trap-net consists of a rectangular trap of netting, into which the fish are conducted by a leader of netting running from some rock on the foreshore. A model of this trap was at the Exhibition.

The cod, after they are taken, are split, salted, dried, and packed in drums, containing 128 lbs., for the Brazilian market; in quintals of 112 lbs. for the European markets, and in boxes of 50 to 100 lbs. for Havana. In the opinion of the Jurors the display of dried fish did not correspond with the magnitude and importance of the fishery; but they specially commended a drum of dried cod packed for the Brazilian market. The livers are used for the manufacture of oil, both for medicinal and commercial purposes; the sounds are soaked, boiled, and exported to Spain, where they are served up with butter; and the roes are exported as bait for the European sardine fishery. The oil so exhibited was pronounced to be excellent. Up to the year 1883 the bones, the heads, and the offal, were thrown away. A company has this year been formed for turning them into guano, and this industry promises to add materially to the value of the Newfoundland fisheries.

The cod fishery—which I have thus attempted to describe—forms much the most important industry in Newfoundland. It affords continuous employment to the fishermen from May till October, and its products are worth £1,250,000, or more than three-fourths of the entire value of the Newfoundland fisheries. It must be recollected, however, that this sum represents the value of the products after they have been dealt with in the factories, and not the value of the fish as they are drawn from the ocean.

Before the cod fishery commences, the fishermen of Newfoundland are engaged in the seal fishery.* The seal fishery is, to a certain extent, regulated by law. Sailing vessels are not allowed to start for it before the 1st, or steamers before the 10th of March. The sailing brigantines, which used to be employed in the fishery, and which were built of Newfoundland timber in the colony, have been almost entirely, or perhaps entirely, superseded by steamers, which are built at Dundee. The obsolete brigantines ranged from 90 to 150 tons burden; the new steamers are powerful vessels; there was a model of one in the Exhibition, to which a gold medal was allotted, measuring 330 tons, which carries a crew of 250 men. The vessels on leaving the coast steer northwards till they meet the Whelping Ice, or the masses of drifting ice on which the whelps or young seals are born. The crews of the steamers are disembarked on the ice, and the young whelps knocked on the head without mercy. The skins and fat are stripped off them, and the carcases left on the ice. After the slaughter of the young seals, the old seals, which it is more difficult to approach, are shot and treated in the same way. The slaughter ceases on the 10th of May, when the laden vessels return to Newfoundland. The steamers during the rest of the year are engaged as ordinary traders; the men at once take part in the cod fishery. As the men have a direct interest in the fishery—they receive one-third of the proceeds, the owner of the vessel taking two-thirds, and finding all food and equipment—the operations are carried on with vigour, and the fishery produces on an average £220,000 a year.

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* Throughout this account I have used the word fishery in its popular sense. It is of course, strictly speaking, inaccurate to talk of a fishery for a mammal, like a whale or a seal, or for a crustacean and a mollusc, like a lobster and an oyster.

There are two kinds of seals taken in the fishery—the *Phoca Greenlandica*, or the harp seal, and the *Phoca cristata*, or the hooded seal. The harp seal, which is the more common of the two, owes its name to the large mark on the side of the old seal, which in the female is black, and in the male is brown. The young of the harp seal is white; the young of the hooded seal grey, with a bluish tinge on the back, which has gained for them the common name of blue backs.

The products of the fishery are the fat and the skins. The latter are salted and exported to England, where they are used in the manufacture of harness and boots; the former is converted into oil. Under the old process of conversion it used to be placed in vats, from which the oil dripped into pans, the colour of the oil deepening as the fat gradually decomposed, and the oil being successively known as pale, tinged, straw, and brown. Under a new process the fat is cut into pieces by a machine, made on the same principle as a sausage-machine, and is passed into a tank, heated with steam to a temperature of 180 degrees, whence it comes out with the consistency of cream. It is then exposed to the action of the sun in tanks roofed with glass, and the oil from these tanks comes out white. The oil thus treated is worth £2 a ton more than the best pale oil treated in the old way. The oil so dealt with in this factory—of which an elaborate model was exhibited by Messrs. Grieve—was pronounced to be superior to any other exhibit of the kind in the Exhibition.

In addition to the seal fishery, and the cod fishery, and the subsidiary fisheries for squid and capelin—the bait for cod—Newfoundland enjoys a fishery for herrings, a fishery for salmon, and a fishery for lobsters. The herring fishery, the most important of the three, produces £120,000 a year. It may be roughly stated that about one-third of the herrings so taken is consumed in the colony; one-third is salted and exported; while the remaining third is sold to French and American fishermen for use either as bait or food. The Labrador herrings, which form the bulk of the export trade, are considerably larger than the British herrings; they are taken in fixed nets, made either of hemp or cotton, and packed in barrels weighing about 2 cwt.

Newfoundland is watered with numerous rivers. Some of them rise in elevated land which attains a height of 2000 feet above the sea. They are said to be full of salmon, and laws for their protection—which, however, have not been enforced—have been passed by the Legislature of the colony. The fishery, however, has not been developed, and the total annual produce only amounts to about £24,000 a year. The lobster fishery, which is prosecuted on the coasts of the colony, yields about the same sum annually, or £21,000.

CANADA.

Newfoundland, of course, is in the immediate neighbourhood of Canada. The Canadian fishermen have easy access to the Newfoundland Banks, and the Canadian fisheries produce rather more than twice the sum yielded by the Newfoundland fisheries, or £4,000,000. From a fishery point of view, however, the vast dominion of Canada, which occupies a territory almost as large as Europe, is only a geographical expression. The sea fisheries of Canada are practically confined to "Nova Scotia, Quebec, New Brunswick, and Prince Edward Island, whilst the provinces of Ontario, Manitoba, and British Columbia, are celebrated for their inland fisheries." ('Fisheries of Canada,' by L. Z. Joncas, p. 7.)

The relative importance of the fisheries of these provinces may be seen from a table published in the very elaborate report of 1882 of the Department of Marine and Fisheries.

VALUE OF FISHERIES IN 1882.*

	$	cts.
Nova Scotia	7,131,418	36
New Brunswick	3,192,338	85
Quebec	1,976,515	81
Prince Edward Island	1,855,687	25
Total of Eastern or Atlantic Provinces	14,155,960	27
British Columbia	1,842,675	05
Ontario	825,457	02
Total	$16,824,092	34

In the Eastern or Atlantic Provinces the cod fishery is of the chief importance. Without including the value of the kindred fish taken on the cod lines, the cod alone yielded in 1882 nearly 4,000,000 dollars to the Canadian fishermen. In Nova Scotia, where the fishermen live on the shores of the Atlantic itself, the fishery is carried on in large schooners, carrying from ten to thirteen hands, a model of one of which was at the Exhibition. In the other provinces the fishery is conducted in open boats, built like whale-boats, one of which, exhibited in full sail, obtained, and deservedly obtained, special commendation from the Jury. Though, however, the open boats of Quebec and New Brunswick are specially distinguishable for their sea-going capacity, there are indications in Canada—as it will afterwards be seen that there are indications elsewhere—that the fishery must ultimately pass into the hands of those who use the largest boats, and who embark the most capital in the industry. In 1882 the yield of the Nova Scotia cod fishery—where large vessels are used—increased from $2,477,873 to $2,600,736. In the three other provinces, where open boats are used, the yield of the same fishery decreased from $1,990,518 to $1,178,164.

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* Mr. Joncas gives a calculation to show that the gross value of the Canadian fisheries reaches $27,000,000; but I can find nothing in his paper (p. 38) which induces me to throw over the official statistics of the Canadian Government.

It may therefore, I think, be assumed that the fishermen of Nova Scotia, seated on the Atlantic, are gradually, but surely, obtaining a monopoly of the Canadian cod-fishery. There is little in the circumstances of the fishery which requires special notice. It is conducted with long-lines, 600 to 1200 fathoms long, baited with herring, capelin and launce. The bait are caught, day by day, in seines, by the fishermen themselves. The schooners, on which the dories or flat-bottomed boats in which the men fish are carried to the fishing-grounds, remain on the banks till their holds are full of fish, the fish as they are caught being split and salted on board. In the Gulf Fishery, however, the fish are landed at one of the great fish-curing establishments of Canada. A Canadian fishing establishment "constitutes a small village. In some of them the visitor can count no less than 120 dwellings. . . . The stage is placed as near as possible to the beach: at one end is a wharf called the stage-head, extending far enough into the sea for boats loaded with fish to come alongside of it at low tide. . . . . At the end of the stage nearest the wharf are the tables on which the cod is dressed. . . . . Three men are employed in the operation of dressing, viz. the cut-throat, the header, and the splitter. . . . The cut-throat, armed with a two-edged knife, seizes the fish, cuts its throat, and having opened it down to the navel with a single stroke of his knife, passes it to the header. The header detaches the liver, which he throws into a barrel placed near him, and with the same hand tears out the entrails, after which with his left hand he cuts off the fish's head. The splitter now seizes the fish, and with a single stroke of his knife he removes the back-bone. . . . . From the hands of the splitter the cod passes into those of the salter, who places it on a pile, spreading it carefully with the flesh up, and with a wooden shovel scatters a layer of salt over each row . . . . The cod is left piled in this way for four, six, or eight days. Then the fish is carefully washed, . . . when it is put in piles again on the stage, in order that all the moisture may drain off from it. After a day or two, the fish are spread out one by one on flakes, in order that they may be deprived of all the water they contain, and be reduced to that dry state in which they may be preserved for several years, even in hot climates" (Joncas, pp. 15, 17).

I have cited this description at some length because the Canadian exhibit of cured cod was judged by the Jury to be of peculiar excellence, and because the whole process of curing, &c., was admirably illustrated by the models at the Exhibition. The cod thus cured, I may add, is sent to Spain, Portugal, the Mediterranean, Brazil, and the West Indies. The heads are consumed in Canada. No use has hitherto been made of the refuse; but I was told by Mr. Wilmot, one of the Executive Commissioners of Canada, to whom I am much indebted for information, that the manufacture of guano from the refuse is now commencing in Canada.

It is stated by Mr. Joncas, in the pamphlet which I have already quoted, that the dry fish exported from Canada in 1881 was worth $5,602,250, while the sounds and oil brought up the value of the export to $5,828,156. "If to that sum," adds Mr. Joncas, "we add the value of pickled fish sent to local markets for home consumption, we will have a grand total of $16, 500,000." I quote this statement, which does not, however, entirely agree with the official statistics for 1882, because it gives a striking idea of the importance of the Canadian cod fishery. It shows, also, that the value of the fish in the market must be from three- to four-fold its value on the coast, a circumstance which seriously affects the statistics of other countries, such as Newfoundland.

In Canada the lobster fishery is only second in importance to the cod fishery. It is stated, indeed, that "the extraordinary development of the lobster fishery" has diverted the fishermen of Quebec ('Fisheries Statement,' p. 51) and of Prince Edward Island (*Ibid.* p. 170) from the cod fishery. On the shores of Prince Edward Island alone upwards of 22,000,000 lobsters were taken in 1882 (*Ibid.* p. 175), and the whole seaboard of Canada produced in the same year 16,800,000 pounds of canned lobsters, worth $2,780,000. The vast industry which these figures represent is of modern growth. Ten years ago the fishery was almost unknown, and there were only 64 factories for the preparation and canning of lobsters. Since that time more than "400 of these establishments have been built, and are now in full operation;" and the Canadian reports are full of gloomy anticipations that over-fishing may lead to the deterioration of the fishery (Joncas, p. 28).

Herrings rank as the third most valuable product of the Canadian fishery. The herring fishery produced in 1882 more than $2,000,000. The fish are taken on the coasts by fixed nets and ground-seines, and on the banks by purse-seines. I shall describe the latter mode of fishing more particularly later on. The fish are sold either pickled, smoked, or frozen for the market. The Labrador herrings are of large size, and command a special market. The Nova Scotia fishermen catch the largest proportion of the Canadian herrings. They catch also the largest share of the mackerel, which yield above $1,170,000 to the Canadian fishermen. Except in Nova Scotia, and to a lesser extent in New Brunswick and Prince Edward

Island, I understand that this fishery is still undeveloped. The mackerel, like the herrings, are pickled, but a certain number of them are also preserved in cans.

These four fisheries—the fishery for cod, the fishery for lobsters, the fishery for mackerel, and the fishery for herrings—produced in 1882 $10,000,000 out of the $16,824,000 earned in that year by Canadian fishermen. The only other fishery of material importance is the fishery for salmon, with which, perhaps, I ought to connect the general freshwater fisheries of Canada.

Salmon are found both on the Atlantic and on the Pacific coasts of Canada. Rod fishermen are rapidly discovering the value of Canadian waters, and Canada may possibly hereafter attract sportsmen from the United Kingdom as largely as Norway attracts them now. Canadian anglers, I may mention in a parenthesis, use shorter and lighter salmon rods than those used in this country. Some very fine rods, which attracted especial commendation from the Jury, were shown by Messrs. Scribner of St. John's (Catalogue, p. 159). I am more concerned in this Report, however, with the commercial than with the sporting aspect of the Canadian salmon fisheries. Canadian salmon reach the English market in two ways. A large and increasing quantity of salmon on the Atlantic coast is frozen as it is caught, and in this state is sent either to the great markets in the States or to the United Kingdom. On the Pacific rivers, on the contrary, the fish are preserved in tins or cans; and the Canadians boast that the largest canneries in the world are in British Columbia; the largest canneries in the world are undoubtedly on the Pacific coast of America.

The extent which this trade has attained may be judged from a few figures. Salmon caught in Canadian waters in

1882 yielded $1,800,000 to the fishermen, and $1,410,000 (or more than three-fourths of the whole amount) was the value of canned salmon. The salmon so canned weighed 12,282,000 lbs., and, supposing that each fish yielded 8 lbs. of flesh, more than 1,500,000 salmon must have been taken for the canneries. When it is added that 3,493,616 lbs. of white fish, worth $279,489; 1,991,989 lbs. of pickerel, worth $116,468; and 540,725 lbs. of maskinougé (*Lucio perca*), worth $36,097, were also taken, some idea may perhaps be formed of the importance of the freshwater fisheries of Canada.

The fish are caught in various ways: salmon on the coasts and white fish in the lakes are caught in stake-nets or trap-nets, as the Canadians call them. There is no law against the erection of trap-nets, but a small licence has to be paid to the Government for the privilege of erecting them. In addition to the trap-nets, a mode of fishing (represented by a model at the Exhibition) which is peculiar to Canada is practised on the great lakes. A long gill-net, frequently 5 to 15 miles in length, is wound round a large reel, and placed on board a small steamer. The bottom rope is heavily leaded, the top rope buoyed with cork. One end of the net is firmly anchored, and the rest of the net is gradually paid out from the steamer. On the morrow the boat returns, takes in the net, and secures the fish which have been caught. But while she is taking in the net she is, with singular ingenuity, made to pay out a fresh net in the line of the old one. In other words, at one journey she performs two operations.*

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* Jury No. 11 said of this exhibit: "The most interesting and valuable exhibit in the whole class is that of the steam launch used on the large American lakes for shooting and hauling the nets at the same time. These nets are said to be some 6 or 8 miles long, the

Trap-nets and gill-nets of this character naturally alarm the fish preserver. A general apprehension exists in Canada that fisheries thus fished must be soon exhausted, and steps have been taken by the Canadian people and the Canadian Legislature to repair the waste which it is assumed is going on. In Canada the Legislature has even thought it necessary to regulate the fishery for cod and herring (Joncas, p. 43). It has adopted strict regulations for the preservation of salmon and freshwater fish; and the Canadian Government, so Mr. Wilmot tells me, employs thousands of river guardians, to each of whom a small sum is paid, to see that the close seasons are observed and the other regulations obeyed. But the Canadians mainly rely on artificial breeding to remedy the scarcity produced by over-fishing; and, though this subject will be more fully dealt with in connection with the exhibit of the United States, it may be desirable to describe here the course which artificial fish culture is taking in Canada.

Fish breeding was experimentally commenced in Canada in 1869 by Mr. Wilmot. Since 1876 it has been conducted on a large scale. There are now eleven hatcheries in the Dominion; the Dominion Government pays the whole cost connected with them; and in the "fall" of 1881 no less than 58,162,000 eggs of salmon, salmon-trout, trout, and white fish were dealt with in these hatcheries, and no less than 29,299,000 of these fish and 26,500,000 pickerel turned into Canadian waters. Fish breeding in the Dominion is, therefore, conducted on a very large scale. It is, perhaps, too soon to determine whether it is attended with the

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steamer as it goes along shooting the net over the stern from a reel on which it is wound, and hauling over the bow the net that has been shot on a previous occasion. In our opinion this method of working nets deserves the attentive consideration of fishermen."

success which is ordinarily claimed for it. Mr. Wilmot is of opinion that it takes six years to make any impression on the fisheries by this means; and, if this conclusion be right, the operations of 1876—the first year on which fish breeding was attempted on a large scale—would not have been perceptible till 1882. It is, however, worth while observing that the great increase in the production of the freshwater fisheries of Canada has occurred in British Columbia, while fish breeding has been hitherto solely confined to the other provinces of the Dominion. During the last four years the "pack" of Columbian canned salmon has risen from 1238 tons in 1879, to 1310 tons in 1880, to 3764 tons in 1881, and to 5357 tons in 1882.* It is obvious that artificial breeding has had nothing whatever to do with this vast increase; and it is not clear that the limits of production of the Columbian rivers has yet been reached. Mr. Joncas indeed states, on the authority of the Provincial Inspector, that "the canneries, notwithstanding the abundance of fish, could not be worked up to their full capacity, owing to the deficiency of labour" (p. 35). The Canadians are, however, perhaps naturally alarmed at a catch of fish which far exceeds any European experience; a serious desire has been expressed for the institution of a State Hatchery in the Columbian rivers; and the Dominion Government contemplate in another year the establishment of a "hatchery" on the Fraser. Mr. Wilmot tells me that such a hatchery, capable of dealing with from 10,000,000 to 40,000,000 eggs, may be erected for from £500 to £1000, and may be maintained at an annual cost of about £400 a year.

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* Salmon are packed in lb. tins in cases, each case holding 4 dozen tins. The pack of 1882 therefore amounted to 5357 tons, or 250,000 cases, or 12,000,000 tins.

THE UNITED STATES.

The fisheries of the United States are of more importance than those of Canada. The exhibit of the United States was unquestionably the most complete collection sent to the Exhibition; and the fisheries of the States present many circumstances which deserve attentive consideration. I am aware of the extreme difficulty of producing any adequate or satisfactory report on these fisheries; but I must endeavour, in the space which is at my disposal, to describe them as clearly as I can.

The fisheries of the United States afford employment to 131,426 persons, 101,684 of whom are engaged afloat; they occupy a capital of $37,955,349, or of about £7,900,000, and they yielded in 1880 a produce of $44,546,053, or of about £8,660,000. With the single exception of the United Kingdom, no other country in the world has fisheries approaching in value those of the United States, while, if it be true as stated by Mr. Goode ('Fisheries of the United States,' p. 8), that the yield in 1883 was 24 per cent. greater than that of 1880, the value of the American fisheries possibly exceeds that of the British fisheries.

The vast wealth, however, derived from these fisheries is unevenly distributed among the several States which comprise the Union. American authors and statisticians group the fisheries under six great divisions, as follows:—

	Number Employed.	Capital.	Produce in 1880.
		$	$
New England States	37,043	19,937,607	14,270,393
Southern Atlantic States	52,418	8,951,722	9,602,737
Middle States, exclusive of lakes	14,981	4,426,078	8,676,579
Pacific States	16,803	2,748,383	7,484,750
Great Lakes	5,050	1,345,975	1,784,050
Gulf States	5,131	545,584	1,227,544

It will be seen from this table that the fisheries of the United States are marked by some peculiar circumstances. While in the New England States, for instance, 37,000 men draw $14,000,000 from the ocean, in the South Atlantic States 52,000 men only draw $9,600,000 from it. The South Atlantic fisheries are, however, engaged in comparatively small boats on the shore and bay fisheries; while the New England fishermen are mainly occupied in fine sea-going vessels on the great fisheries in the open ocean.

There are seven fisheries in the United States which yield upwards of $1,500,000 annually to the fishermen. They are:—

The Oyster Fishery	$13,439,000
„ Cod Fishery	4,000,000
„ Pacific Salmon Fishery	3,300,000
„ Whale Fishery	2,636,000
„ Menhaden Fishery	2,117,000
„ Alaska Fur Seal Fishery	1,541,000
„ Mackerel Fishery	1,501,000

These figures will, unless I am much mistaken, produce a feeling of considerable surprise among well-informed people. Few persons in this country have, I imagine, any notion that the oysters of the United States yield a revenue of $13,439,000, or of more than £2,750,000 annually, and that this industry alone affords employment to 52,805 persons, 38,249 of whom are engaged afloat, and 14,556 are at work on shore. To put the facts in another way, perhaps even Americans themselves are hardly aware that two persons out of every five, dependent in the United States on fishing, are not, strictly speaking, fishermen, but oyster fishermen, and that nearly £1 out of every £3 drawn from American waters is derived from oysters.

Mr. Brown Goode states that 80 per cent. of these oysters are drawn from the waters of Chesapeake Bay. This great natural inlet, running from latitude 36·50 to latitude 39·50, is plentifully fed with the fresh waters of the Susquehanna, the Potomac, and the Rappahannock. A mere glance at the map will show that its waters must be tranquil; their latitude is about the same as that of Naples; and, just as these conditions probably favour reproduction, so the food brought down by the rivers enables the bay to support vast quantities of the mollusc. There does not at present seem to be any indications that the oyster fisheries of the bay are in process of exhaustion. But Mr. Goode apprehends that "a speedy extermination will doubtless result unless some effective means of protection and artificial culture are soon employed" (p. 30). As upwards of 50,000 persons in the States are dependent on oyster fishing, or on the industries connected with it, the "extermination" of the fishery would plainly be attended with disastrous consequences.

Second to the oyster fishery, but second after a long interval, is the fishery for cod. The cod are chiefly taken off the Newfoundland Banks by men who repair to the grounds in the large fishing schooners of the New England States; but who, on arriving on the Banks, fish in the flat-bottomed boats or dories carried to the fishing grounds on the decks of these schooners. Except on the St. George's Bank, south-east of Cape Ann, where a rocky bottom and a strong current interfere with the setting of long-lines, little or no hand-line fishing exists in the States; and long-lines, which Mr. Goode states in the case of each schooner may extend to fourteen miles, and which are baited with 14,000 to 15,000 hooks, are used by the fishermen. The lines, as in the case of Newfoundland, are baited with herring, capelin, and squid. The long-lines are known as trawl-lines in America; and it is a curious circumstance that, while the word "trawl" is used in different senses by Scotch, English, and American fishermen, the engine to which the name applies is everywhere the subject of opposition. In Scotland, or at any rate the west coast of Scotland, the fisherman who talks of a trawl means a seine-net, and the drift-net fishermen of Loch Fyne are urgent in complaining of these seine-trawls. In Eastern Britain the trawl is the beam-trawl, which is the chief means of supplying the great fish markets of England, but which is the object of perpetual complaint by the drift-net fishermen and by the long-line fishermen; while in the United States these long-lines are themselves called trawls, and the trawls are again abused by the hand-line fishermen. It is a curious circumstance that a word which has not had a life of a century, and which is probably only corrupted from another word, "trail,"* should have been capable of being applied to three different modes of fishing, and that each mode should have been made the subject of violent opposition. The long-line fisherman of Eastern Britain, who abuses trawling, would be surprised to learn that in America he himself would be known as a trawler, and be made the subject of similar abuse.

The cod which are thus caught are worth $4,000,000, or nearly £800,000, a year to American fishermen. But this sum, it must be recollected, represents the value to the fishermen, and not the much higher value of the fish after they are cured. I believe I am right in saying, that if dried in the simplest way the cod after it is cured would be worth

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* The word trawl is not in Johnson's Dictionary; but the word TRAWLER men is defined by Bailey's 'English Dictionary,' Fourteenth Edition, 1751, as "Fishermen who use unlawful methods of destroying the Fish in the River of Thames."

$5,500,000, or nearly £1,100,000;* or, if the secondary products of the fish be included, to $6,100,000, or more than £1,200,000, a year. Cod are cured in two ways in the States, and are, when so cured, respectively known as pickled cod and kenched cod. Pickled cod are preserved in brine, and, though they are less easily handled by the salesmen, purchasers are gradually ascertaining that their quality is superior to that of the kenched cod. In consequence, the pickled cure is gradually superseding the kenched cure. In addition, however, to the ordinary kenched or dried cod, the American curers are putting up small and attractive packages of boneless dried fish, while Mr. Alden has introduced a new process of cure by evaporation and desiccation (Mr. Goode, p. 10).

These processes all tend to increase the bulk of the waste products of the curer. In the first stage of the curing process the waste products are thrown away; at a later stage they are made into guano. The Americans have now found that they can turn them to more profitable account by making them into isinglass and glue. All these processes were fully illustrated in the United States section; and I ought, perhaps, to add that, while Mr. Alden received a gold medal for his evaporated cod, and another gold medal was awarded to the boneless cod, the special prize for the best collection of dry-salted fish in the Exhibition was awarded to the United States Commission.*

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* The value of the cod caught in the United States is estimated, as in the text, at $4,000,000. But the statistics of the fisheries of Maine show that in that State 52,494,325 lbs. of cod were taken, worth $419,000. It is a fair assumption, therefore, that in the whole of the States some 520,000,000 lbs. of cod were taken. The 52,000,000 lbs. of fish in Maine were reduced to 18,090,352 lbs. of dried fish, worth $565,325. According to the same proportion the 520,000,000 lbs. of cod in the States, worth $4,000,000 to the fishermen, would be worth $5,500,000 after they were cured (Statistics of Maine, pp. 7, 9). Mr. Brown Goode, however, states that the "secondary products in the cod fisheries amount to more than 14½ per cent. of the value of the fish as taken from the water" (p. 13). This would raise the gross produce of the cod fishery to about $6,100,000, or say £1,200,000 a year.

The Pacific salmon fishery ranks third in importance among the fisheries of the United States. While the cod fishery yields $4,000,000 to the fishermen, the Pacific salmon fishery yields $3,389,000. This prodigious industry, which has almost sprung into existence during the last ten years, employs 3370 fishermen. The chief rivers which support the fishery are the Columbia and Sacramento. The Columbia, in 1880, produced 1,925,000 fish, weighing 38,500,000 lbs.; the Sacramento yielded 606,000 fish, weighing 10,000,000 lbs. If these vast figures, which are taken from Mr. Brown Goode, are correct, every fish in the Columbia must have weighed on an average 20 lbs.; every fish in the Sacramento must have weighed about 16 lbs. Perhaps some idea may be formed of the extraordinary nature of these figures if I add that, I do not believe that any river either in Scotland or in Europe yields

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* There is a striking instance of the ingenuity of the Americans in one of the models of the establishments for drying cod. In the early ages of the industry every fisherman dried his fish on his own brush flakes, just as they are now dried in Newfoundland. Later on they were dried on large flakes specially connected with the curing factory. It was found, however, that the hot mid-day sun broke the fish up, and that it was consequently necessary to mitigate the heat by covering them with cotton. A manufacturer, to avoid the labour of thus covering the fish day by day, has placed the flakes which run east and west on an axis. By raising the axis in the centre of the flakes he can of course prevent the sun beating direct on the fish (Catalogue p. 200, No. 124). This manufacturer has obtained—as he deserved to obtain—a large portion of the trade as a reward for his ingenuity.

100,000 fish annually to the fishermen, or that the average weight of fish in any British river exceeds 12 lbs. The number of fish taken in the Columbia is therefore about 20 times, the weight 30 times, greater than that of the salmon taken in any British river.

The large majority, about four-fifths, of the fish which are thus taken are sold to the canneries, and dealt with in the same way as in Canada. In 1880, 655,676 cases, containing 31,453,152 lb. tins, were turned out in these canneries. The pack, therefore, in the American Pacific States is two and a half times greater than that in the Canadian Pacific territory.

It is of the highest importance and of the greatest interest to determine whether this vast take of fish, far exceeding anything with which we are acquainted in Europe, is exhausting the fisheries. If a river of the size of the Columbia can be made to yield, in round numbers, 2,000,000 salmon a year, there is apparently almost no limit to the production of salmonidæ. Mr. Brown Goode says that, "though the capture is enormous, it has been demonstrated that the supply can easily be kept up by a small outlay in artificial culture." But artificial culture in the United States is conducted on very different principles from those which regulate it in this country. "The proper function of public fish culture," writes Mr. Brown Goode (p. 67), "is the stocking of public waters with fish in which no individual can claim the right of property. . . . . Public fish culture is only useful when conducted upon a gigantic scale; its statistical tables must be footed up in tens of millions." At a single factory in Michigan, 70,950,000 eggs (salmonidæ) were handled in 1882-3, and the manager hopes next season to hatch 500,000,000 eggs of white fish (Goode, p. 71). The United States Fish Commission has for years had a steamer specially devoted to fish-hatching. They have constructed a railway car, magnificently fitted up, for the express purpose of transporting fish and fish ova.

I was naturally anxious to obtain specifically some account of the results which had ensued from a gigantic and unprecedented experiment; and Mr. Earll, to whom I applied for information, gave me the following answer. He said that a gentleman ten years ago built a cannery on the Sacramento, and that he found that the river was so exhausted that he could not obtain an adequate supply of fish. In consequence he closed his factory. Three years afterwards he heard that his old factory had been opened by another person; the following year he went and built a cannery himself, and there are now fifteen canneries on the river, all obtaining all the fish they require. On certain days last year 30,000 fish were thrown away, as the fifteen canneries, already working up to their full strength, had no room for them.

Such is Mr. Earll's account. These great results are alleged to have been produced by a hatchery on the McCloud, a tributary of the Sacramento. This hatchery was established by Mr. Livingston Stone in 1872, or presumably the year before Mr. Earll's informant opened his original cannery. "In the eleven years since the salmon-breeding station has been in operation, 67,000,000 eggs have been taken, most of which have been distributed in the various States of the Union. Several millions, however, have been sent to foreign countries, and about 15,000,000 have been hatched in the Sacramento, and other tributaries of the Sacramento. So great have been the benefits of this restocking of the Sacramento, that the statistics of the salmon fisheries on the Sacramento show that the annual salmon catch of the river has increased 5,000,000 lbs. during the last few years" (Brown Goode, p. 72).

These remarkable figures deserve careful study. If they be accurately given, and there is every reason for accepting them as accurate, and if Mr. Brown Goode's inference from them be correct, it is not too much to say that the views respecting the cultivation of salmon which have been hitherto prevalent in this country, deserve to be reconsidered. Mr. Brown Goode tells us that the produce of 15,000,000 eggs, say 12,000,000 salmon, have in eleven years been turned into the Sacramento and its tributaries; in other words, that 1,100,000 salmon have been annually turned into the river. But he adds that the catch has been increased by 5,000,000 lbs. a year, or at 16 lbs. a fish—the average weight of fish in the Sacramento—by 312,500 fish. If this inference be correct, two salmon have been caught for every seven salmon turned into the river; and the artificial culture of salmon is the most profitable industry which has ever been devised by man. It is fair, however, to add that the experience which the Americans have acquired in this respect is inconsistent with the ordinary experience in this country. In 1858 the Tweed Commissioners marked 240 "blacktails"—I use the local name on the Tweed for the young of bull-trout—which had already survived all the danger of residence during the par and smolt stage in the river. In 1859, 166 additional blacktails were marked. Three of those marked in 1858, and five of those marked in 1859, were subsequently recaptured either in the Tweed or in other parts of Scotland. Out of 406 fish marked by the Commissioners, therefore, eight, or one in every fifty, have been recaptured. Assuming, therefore, that the whole of the 1,100,000 salmon annually turned into the Sacramento survived to the migratory stage—an assumption opposed both to experience and to reason—some 20,000 to 22,000 ought, according to the experience of the Tweed, to have been recaptured. But, instead of 22,000 being recaptured, nearly fifteen times the number, or 312,000, are said to have been recaptured. It seems to follow from this argument that either some other cause than artificial cultivation must have been affecting for good the fisheries of the Sacramento, or that the dangers to which salmonidæ are exposed in American waters after their descent to the sea must be very different from those to which they are exposed in British waters.*

The Pacific salmon fishery is yearly increasing in importance. The whale fishery of the United States, which ranks next in value to the salmon fishery, and which is estimated to produce $2,636,000, is decreasing in value. Perhaps some critics may conclude that the increased demand for canned salmon has had almost as much to do with the growth of the salmon fishery as artificial cultivation. It is certain that the decreased demand for sperm oil, consequent on the production of petroleum, has had much to do with the decrease of the whale fishery. The fact is very fairly stated by Mr. Temple Brown, in the excellent handbook on the whale fishery which he has written to illustrate the admirable exhibit of whaling appliances in the United States Court. "The whale fishery of this country," writes Mr. Temple Brown, "was in its zenith of prosperity about the middle of the present century, when the fleet numbered

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* See for the Tweed, 'Tweed Salmon Fisheries,' p. 112. There can, of course, be very little doubt that a river flowing through a comparatively unsettled country is capable of supporting a much larger stock of fish than a river flowing through a settled country. Forests are full of fly life. The cutting down of trees diminishes the ephemera. The food of fish is thereby concurrently reduced, and the fish decrease in numbers.

736 vessels, aggregating 231,406 tons. From 1854 to the present time there has been an almost constant decrease in the size of the fleet. The chief cause of this decline has been the introduction of mineral and cotton-seed oils at very low prices, which made a great reduction in the value of whale oils, and has rendered the cost of production equal to, if not greater than, the market value of these articles" (p. 27). The fleet in consequence has been gradually reduced from 736 to 181 vessels,* its capacity from 231,406 to 38,637 tons.

Mr. Temple's explanation of this decrease is worth recollecting, because it throws a new light on the condition of the whale fishery in other countries. Whale fishing had also its representative collections in the Canadian, in the Chilian, and in the Hawaii Courts. I have hardly noticed, and I shall not be able to notice except incidentally, collections sent from Hawaii or the Sandwich Islands. But I am anxious to point out a curious passage in the introduction, published in the Official Catalogue (p. 274), to this collection. "About fifty years ago," says the writer, "a new and profitable but demoralising industry sprang up, namely, the landing and transshipping of oil in the group. The whaling vessels of the Pacific and the transships called there, and more than 300 visits have been received in a single year. These had to be supplied, and money and money's worth became abundant. The first whale ship belonging to Hawaii was fitted out in the year 1834. A record of the oil and bone landed and unshipped shows in the year 1851 the following quantities, viz.: Sperm oil, 104,362 gallons; whale oil, 909,379 gallons; whalebone, 901,604 lbs. The trade culminated in the year 1858, when there were of sperm oil, 222,464 gallons; whale oil, 2,551,382 gallons; bone, 1,614,710 lbs. The trade then declined, so that in the year 1874 [*sic*] it records only, sperm oil, 37,812 gallons; whale oil, 312,305 gallons; bone, 104,715 lbs. The whales in the nearer ocean had, in fact, been over-fished, and had changed their habitat to more distant grounds." I have quoted this passage at length because it affords a striking proof of the readiness with which sensible writers associate every decrease of a fishery with over-fishing and the exhaustion of the ocean. It is obvious that the whale trade of Hawaii has followed precisely the same course as the whale trade of the United States; and it is a fair assumption that the fishery of Hawaii, like that of the United States, has declined, not because the whales are over-fished, but because sperm and whale oil have been driven out of the market by cheaper oils.

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* Mr. Temple Brown by an obvious misprint, which is copied by Mr. Brown Goode (p. 37), says 171 vessels.

In its reduced state, the American whale fishery attracts a capital of $2,857,650, and affords employment to 4198 persons; 111 of these vessels are engaged in the Atlantic, 25 in Behring's Straits, 22 in the Pacific, and 5 in Hudson's Bay. The Pacific Arctic grounds are said to be the most productive whaling ground frequented by American whalers.

The fishery for menhaden ranks after the whale fishery, or fifth in value among the American fisheries. It is, in its present form, a modern industry, and at once one of the most interesting and characteristic of American fisheries. The menhaden—the *Brevoortia tyrannus* of American naturalists—is one of the *Clupeidæ*, and closely allied with the shad of our own coasts. Twenty-five years ago it was used for bait and for manure, while a few barrels were annually salted, and either consumed on the coast or exported to the West Indies. Its use as bait is gradually being discontinued, the mackerel, which used to be caught with lines baited with menhaden, being now chiefly taken in purse-seines. In 1872 a fresh use was found for it, and large quantities of menhaden were canned, and sold as sardines. This industry, in its turn, has ceased, and menhaden are now chiefly used in the manufacture of guano and oil. In 1880, the menhaden oil and guano industry employed a capital of $2,362,841, and afforded occupation to 3635 persons—2543 afloat, and 1092 on shore. It yielded a return of $2,116,787, and $2,066,396 gallons of oil, and 68,904 tons of guano were the chief products of the fishery (Mr. Brown Goode, p. 41).

The menhaden fishery is conducted in steamers; each steamer, which is usually of about 60 tons burden, carries from twelve to fourteen men. A look-out is placed on the mast to give notice of a shoal of fish. On the shoal being seen, all the crew, with the exception of the cook and engineer, leave the steamer. A small light boat—the driver—is rowed in advance of the shoal, moving as the shoal moves; a larger boat, in which the purse-seine is carried, shoots the seine round the shoal. The bottom rope of the seine is then run up together, so as to draw the seine into a purse, and the fish are ladled out of the purse by a scoop-net into the steamer, which is run up by the cook and the engineer to the net. So soon as the steamer has succeeded in filling her hold by this operation, she returns to the factory. The fish are placed in a bin at the top of the factory, from which they are carried by an endless chain into the factory, and tipped into vats. In the vats, each of which holds 60 barrels of fish, the fish are cooked with steam. The cooking process breaks up the fibre, and thus enables the oil to come more freely from the fish, which are subsequently placed under an hydraulic press. The oil and water forced out of them by this operation runs into the oil-rooms, the residue of the fish are spread out, mixed with sulphuric acid, and dried either in the sun or by hot air: the product thus treated being an admirable fertiliser. I have based this description on the excellent models in the United States section, and the explanation of them which was courteously afforded to me by Mr. Earll.

Sixth on the list of American fisheries is an industry which is not a fishery. Two small uninhabited islands—St. Paul and St. George—off the coast of Alaska, in longitude 165° West, and in latitude 56° and 58° North, have been found to be the breeding-places of the seal; and, according to an illustrated map in the American section, 3,760,000 seals annually rest on St. Paul, 195,000 on St. George. The islands, which were purchased, with Alaska, by the United States from Russia, are the property of the United States. They are leased to a company. But the Government stipulate that the company shall only limit its take to 100,000 young male seals a year. Assuming that the census of the seals—which is given in the United States section—is accurate, the limit seems a very small one: 4,000,000 seals must presumably contain 2,000,000 female seals. If only half of these females pup each year—the period of gestation with the seal is ten months—1,000,000 young seals must be annually born on these islands. The American Government practically therefore limit the catch of its lessees to one-tenth of the produce of the islands.*

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* There is a great deal of valuable information about seal fisheries in the paper read by Captain Temple at one of the Conferences of the Exhibition, and in the discussion upon it. Captain Temple's remarks specially refer to the Canadian seal fishery, and to the fur seal fisheries of Southern Patagonia. But in the succeeding discussion, Mr. Ridley and Mr. Martin brought out many facts of interest in connection with the fisheries of Canada, Newfoundland, Greenland,

Mr. Brown Goode places the yield of the Alaska fur seal fishery at $1,541,000 a year. The mackerel fishery he estimates to produce $1,501,000. The fishery employs "468 vessels, and 5043 men, and produced 131,939,225 lbs of fresh fish, of which 117,500,000 lbs., or 343,808 barrels were salted, the remainder being canned or sold fresh" (Mr. Brown Goode, p. 42). The yield of the fishery is very unequal. According to a diagram exhibited in the American section, the take rose to 385,000 barrels in 1831, fell to 50,000 barrels in 1840, rose to 334,000 barrels in 1851, fell to 100,000 barrels in 1859, and rose again to 400,000 barrels in 1881. These variations afford a good illustration of the variations to which many important fisheries are undoubtedly subject from natural causes. It is more important for my present purpose to point out that the development of the mackerel fishery, like that of the menhaden fishery, has been greatly facilitated by the introduction of the purse-seine. It is unnecessary for me to repeat the description of the engine which I have already given. It is sufficient to say that the purse-seine and the long-lines are the two chief instruments of fishing used by the fishermen of the United States.

There are many other fisheries of the United States of

Russia, and Japan. The Patagonian seal fishery is carried on mainly by American and Chilian fishermen; and in the Chilian section—one of those sections of the Exhibition which contained much of great interest, though not of the kind of interest which enables me to devote much space to it here—many objects illustrating the seal fisheries of Chili were exhibited. I ought to add, perhaps, that "in consequence of the great development of the seal fisheries in and about the Straits of Magellan, the Chilian Government has lately appointed a Commission to study the question and to draw up a report thereon in order to introduce a law to enforce a close time" (Catalogue, p. 246).

considerable importance. Migratory *Clupeidæ*—the shad and the alewife—are estimated to yield upwards of 61,000,000 lbs. of food, and to be worth $1,500,000 a year. Herrings return $1,130,000; clams $1,014,000, white-fish (*Coregoni*) $900,000, and lobsters $732,000 to the fishermen. I am forced, however, to pass on from these subjects, in order that I may be able to describe the last great group of fisheries to which I propose to refer in detail, viz., the fisheries of those countries which either abut on, or fish in, the North Sea.

THE NORTH SEA.

The countries to which I refer are, of course, Belgium, Denmark, France, Germany, Holland, Norway, Sweden, and the United Kingdom.

GERMANY.

It must have been a matter of regret, to every one who had the opportunity of visiting the International Fisheries Exhibition which was held in Berlin in the summer of 1880, to observe how very small a part Germany had taken in the present collection. It could hardly be said that Germany was represented at South Kensington at all. Yet the Germans are taking considerable interest in fishery matters; they are in advance of most, if not of all, European countries in artificial fish culture; they possess fisheries in the great haffs of Northern Germany, which are perhaps distinct from those of any other country; and they probably know more about the scientific cultivation of pond-fish than any other people in the world. A few patriotic Germans have, moreover, of late years endeavoured to develop a herring fishery in the North Sea; and, though their efforts had not, up to 1880, been successful, and though, I believe, success has not yet rewarded them, there would have been considerable interest in any national exhibit which would have illustrated the history of the company formed for the purpose.

In the absence of any such collection, I am unable to do more than refer to the remarks which I made on the German fishery in a Report which I drew up in 1880 (Inspector's Salmon Fisheries, 20th Report, p. 29), and I am forced to assume that Germany does not directly draw much wealth from the waters of the North Sea. The adjacent kingdom of Denmark was also only imperfectly represented at the Exhibition. But, with the aid of the Catalogue, and of the information which I procured at South Kensington, I am able to give some account of the Danish fishery.

DENMARK.

The Danish fisheries are said to employ, directly or indirectly, 11,300 families; about 1000 vessels, some decked and some with wells, and some 5000 open boats are engaged in fishing. The welled vessels carry cod and flat fish, caught in the Cattegut, to Copenhagen and the German ports. These fish are caught by long-lines, and are worth 1,378,000 crowns (about £75,000) annually. In addition to this sum, the salmon fishery is estimated to produce 507,800 crowns; the autumn herring fishery, 350,000 crowns; the eel fishery, 1,600,000 crowns; the lobster fishery, 450,000 crowns; the oyster fishery, 300,000 crowns; and the fresh-water fisheries, 150,000 crowns annually. Other unenumerated industries bring up the total value of the Danish fisheries to 5,500,000 crowns (about £305,500) annually.

Of this produce fish worth 2,300,000 crowns are exported; fish worth 2,000,000 crowns are sold in Denmark, the residue is consumed on the coasts by the fishermen and their families. In addition to the home fishery, the Danes enjoy a cod fishery in Iceland, which yields 4,000,000 crowns, and a cod fishery in the Faroe Islands, which yields 800,000 crowns annually. In Iceland, as well as in the Faroe Islands, there are also subsidiary fisheries for herrings, sharks and whales, and it will not perhaps, therefore, be inaccurate to say that the whole of the Danish fisheries yield above £650,000 annually.

Little means existed in London of obtaining information respecting the manner in which the fishing is conducted. But the Danes use excellent nets of flax and cotton, and I have grounds for saying that their fishing machinery generally is of good quality. The principal object in the Danish Court, however, was a canoe used by the natives of Greenland in seal fishing. The kajak or canoe of Greenland is made of sealskin. The implements which the natives use are all of a primitive character. Hide and whalebone take the place of string and rope; the spearheads are made of the bones of the walrus, the floats of the bladder of the seal. The entire "population, which on the 1st of January 1882 amounted to 9752 individuals, subsist entirely on the chase of marine mammalia and birds and on fishery; 2100 kajaks, 2400 nets, 250 large boats, and 270 sledges, with their complement of dogs, are employed, and the annual take may be estimated at 90,000 seals, 15,000 sharks, besides a quantity of small whales, salmon-trout, halibut and cod" (Catalogue, p. 256). Exhibits of this character have, perhaps, no direct interest to practical fishermen, but to the anthropologist they form some of the most interesting features of the recent Exhibition.

SWEDEN.

The collections which were sent by Sweden were of a very different character from those which were received from Denmark. In some particulars, indeed, the Swedish Court was richer than any other section of the Exhibition. I have already had occasion to refer to the interesting objects, exhibited at South Kensington, collected during the Vega expedition by Baron Nordenskiold. I may add now that the collections in the Swedish Court, which illustrated the marine fauna of the country, were exceptionally well arranged, interesting, and complete. Any one, moreover, who took the trouble to examine the fishing instruments used in Sweden must have been struck by the excellence of their manufacture. The Swedish Government is taking exceptional measures to promote the growth of the fishing industry; and there are many reasons for concluding that the Swedish fisheries are increasing in importance.

Yet, if regard be had to the general excellence of the collections which Sweden sent to London, and to the nature of the instruments used by Swedes in fishing, surprise will probably be felt that the Swedish fisheries are not more productive than they are. The total yield of the fisheries of the country is 8,640,000 crowns, or about £480,000 a year.

The comparatively small yield of the Swedish fisheries is partly accounted for by the circumstance of the geographical position of Sweden. She has a long coast-line on the Baltic, but a comparatively short coast-line on the North Sea. She has, therefore, only a limited access to the valuable North Sea fisheries; and the Baltic, on which her eastern coast abuts, is the poorest fishing sea in Europe. The chief Swedish fishery is the herring fishery, which is estimated to yield 3,865,000 crowns. Rather more than two-thirds of this sum is realised by the capture of the small Baltic herring and the herring of the Sound; the residue is obtained from the herrings of the North Sea. Professor Smitt, to whom I am much indebted for information, tells me that the Swedish fishermen always wait for the herrings till they come close in shore for spawning purposes. He has urged them, for years past, but without success, to imitate the example of Scotch and Dutch fishermen, and to go out to sea to meet the fish. His advice is, no doubt, excellent. Migratory fish, like the herring, will occasionally desert tracts of coast for years together; and the fishermen, who wait for the fish, instead of following them or meeting them, will always be dependent on a migration which man has hitherto been unable to explain, and which he is certainly with his present knowledge unable to control.

The other sea fisheries of Sweden are supposed to yield 2,000,000 crowns annually. This sum is chiefly produced by the long-line fishing for cod, haddock, habibut, &c.; but it includes also the produce of the mackerel, lobster and oyster fisheries (Catalogue, p. 355). Some of the fish caught with long-lines are sold fresh, but the greater portion is salted and cured. The produce of the Swedish lake fisheries is estimated at 2,000,000 crowns; of the Swedish salmon fisheries at 625,000 crowns, a sum which is probably about equal to the produce of a single Scotch river, the Tay, and which possibly represents one-fifth of the produce of a single American river, the Sacramento. In addition to these, Swedish fishermen are supposed to derive 150,000 crowns from the produce of the eel fishery.

Several establishments exist in Sweden for fish culture. These establishments are, however, all in private hands, and are conducted on commercial principles. As their produce is not necessarily sold in Sweden, fish culture—as it is practised in that country—cannot be expected to have necessarily any effect on the produce of its fisheries; and the comparatively small yield of the Swedish rivers cannot be, therefore, taken as a proof that artificial cultivation is not attended with satisfactory results. It may, however, on this head be worth while to state that, in Professor Smitt's opinion, the young fry after they are hatched out ought not to be turned at once into the rivers as they are in America, but ought to be kept under the eye of the culturist for some time. Professor Smitt considers that, if they are at once turned out into the lakes and rivers to provide for themselves, considerable numbers must be lost from the many dangers to which all young fish are exposed.

NORWAY.

There is a striking contrast between the fisheries of Sweden and the fisheries of Norway. The visitor to the Swedish Court is struck by the excellence of many of the instruments used in Sweden, and at the same time with the comparatively small yield of the fisheries. The visitor to the Norwegian Court on the contrary is surprised at the rudeness of many of the implements used, and at the vast fishery wealth which Norway possesses. The Norwegians, apparently, have taken advantage of their exceptional position to introduce few improvements into fishing. The Swedes, on the contrary, unfavourably situated, have better nets, and in some cases better boats.

In the centre of the Norwegian Court the Norwegians erected a trophy, on which there were models of all the boats in use on the Norwegian coast. Nearly all of them are open boats; but there is a remarkable peculiarity about many of them which strikingly illustrates the conservative nature of Norwegian fishermen and boat-builders. Many of them are built on precisely the same lines as the old boats of the Vikings. The interesting model of the Viking's vessel, which was found in 1880 buried at Gokstad, near Sandefjord, was in the Norwegian Court; and any one who compared this model with the modern boats fitted with a square sail, engaged in the cod fishery at Lofoten, at Sondmore, or at Helgeland, could not avoid perceiving the close resemblance between them. The Norwegian boat-builder has preserved almost unaltered the old ship of the Vikings; and merely added to it a modern rudder to supersede the old rudder which used to be hung by a rope on the right side of the vessel, a little forward of the stern post, and which gave, among all Teutonic people, the name of starboard, or stearing-board to that side of the ship. (A brief description of the ancient vessel found near Sandefjord, p. 9.)

The same conservative aversion from change which is evident in the Norwegian fishing-boats may be detected also on an examination of Norwegian nets. The Norwegians still use the old heavy hemp-nets, which have been abandoned, or which are being abandoned, by almost every other European country. In the same way they still continue to use the old processes of curing fish which have been practised in past times. They adopt neither the new methods of cure which are stimulating trade in the United States; nor the new cotton nets which are lightening the labours and increasing the efficiency of fishermen in the United Kingdom.

The Norwegian Fisheries employ 70,000 to 90,000 persons, or about one person in every 22 of the whole population. Relatively to its population, therefore, Norway supports a larger number of fishermen than any European country, or than any other country that I have noticed except the colony of Newfoundland. These fishermen drew fish worth 23,274,000 kronor, or nearly £1,300,000 from the Norwegian seas in 1882. This sum, however, only gives an imperfect idea of the importance of the Norwegian fisheries. The great mass of the fish which are caught are cured and salted, and their value in a cured state is very much greater than their value to the fishermen. The exports of fish produce from Norway amounted to no less than 43,130,000 kronor (or nearly £2,400,000) in 1882. The value of the fish exported, in other words, was raised by the process of the cure to nearly double the value of all the fish drawn from the sea; and the export trade of course does not represent the whole take, but the whole take less the amount consumed in Norway.

The two great fisheries of Norway are those for the cod and the herring. Perhaps few people realise the part which is filled by cod in the economy of the world. I have already shown in this Report, that the produce of the Newfoundland cod fishery is estimated, after the fish are cured, at £1,250,000. The Canadian cod fishery yields to the fishers a revenue of nearly $4,000,000 or say £800,000; the fishermen of the United States draw at least as large a sum from cod-fishing, while, as I shall hereafter have occasion to show, cod yield at least £500,000 to French fishermen. In Norway cod alone are worth to the fishermen 13,869,000 kronor, and if the kindred coal-fish, ling and haddock, be added to this, 14,587,000 kronor (or about £810,000). The export trade in this fish is estimated at 29,545,000 kronor, or at about £1,080,000.

The three principal stations for the Norwegian cod-fishery are in the Lofoten Islands; off Vardo, in Finmark; and in the neighbourhood of Trondhjem in Southern Norway. The Lofoten fishery is of the chief importance. The Lofoten Islands are separated by the great Vestfjord—a favourite spawning-ground of the cod—from the mainland. The fishery, which commences in January and which continues to May, employs 26,309 fishermen in from 6500 to 6800 open boats. The fish are caught with hand-lines by the poorer fishermen, and by long lines and gill-nets, or sunk nets in which the cod are enmeshed, by fishermen who have a little more capital. The average catch is said to amount to 26,300,000 fish,* which gives an average take of 1000 fish by each fisherman. Fresh and salt herrings, and pieces of cod are used for bait, while the lines are buoyed, and the gill-nets are buoyed by the hollow glass buoys which were invented by Mr. Christopher Faye of Bergen (Catalogue, p. 303, but *cf.* 'The Fisheries of Norway,' p. 126, by H. B., a work on which the account in the Catalogue seems to be based).

Second in importance to the Lofoten fishery is the fishery of Finmark, in the neighbourhood of the North Cape. The cod are apparently attracted to this portion of the coast by the shoals of capelin, which they follow and on which they prey: 14,000 fishermen, fishing in 4000 boats, are engaged in the fishery from the middle of February to about the end of May. It is estimated that they catch, on an average, 15,300,000 cod-fish, or rather more than 1000 fish for every fisherman. The Finmark fishery, however, probably from being in a more exposed situation, is subject to much greater variations than the Lofoten fishery. In the sixteen years ending in 1881, the latter never yielded fewer than 17,500,000 cod, and never produced more than 28,400,000 cod. The maximum take did not ever exceed the minimum take by much more than 60 per cent. In the Finmarken fishery, on the contrary, the smallest take of the sixteen years was only 5,228,000, the largest take 23,626,000 cod. The largest take, in other words, was 350 per cent. greater than the smallest take.

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* These figures are from the Official Catalogue, p. 306. The statistics on which they are based will be found in the Statistical Tables for Sea Fisheries of Norway, p. viii.

The third of the Norwegian cod fisheries is at Trondhjem, in Southern Norway. According to the Catalogue (p. 303), an average of 7,500,000 cod have of late years been annually taken in this fishery. The anonymous authority, " H. B.," writing in 1876, stated that the produce rarely exceeds 6 or 7 millions of fish. The retrospective tables, published in the Norwegian Statistical Office, places the average annual take from 1876 to 1881 at from 3 to 4 millions. The figures in the statistical tables, however, refer to the take off the coast of Sondmore alone, and it is possible that the Trondhjem fishery, which comprises the Sondmore fishery, includes also a larger area of coast than that at Sondmore.

According to the Catalogue, therefore, the average produce of the three great cod fisheries of Norway amounts to 49,100,000 cod during the winter and spring of each year. "The catch of cod, ling, tusk, coal-fish, and haddock in the summer and autumn is of less importance, and so is the catch of cod in winter and spring at other stations than the above-mentioned parts of the coast. If all these fisheries are put together, the amount of fish caught will be pretty large, as it yields an average export of dried and dry-salted-fish of 75,000,000 yearly, which would answer to about 375,000 tons of live fish."* (Catalogue, p. 303.)

I have given in some detail an account of this fishery because it is in one sense the most important fishery in the world. It is conducted close to the coast, almost exclusively in open vessels, and with primitive machinery. The cod taken are either dried without salt or dried with salt. Dried without salt, they are known as "stock-fisch," and are chiefly sold in Italy and Spain; dried with salt, they are called "klip-fisch," and are sold chiefly in Spain and Brazil. Any one interested in the details of these operations, will find an interesting account of them in the work which I have already quoted ('The Fishing Industry of Norway,' p. 135). It seems hardly necessary to describe them here, as there can be very little doubt that the Norwegians are behind the Americans in fish curing, and practical fishermen have, therefore, much more to learn from the United States than from Norway. But the process of cure largely increases the value of the produce of the fishery. I have already stated that the value of the cod, coal-fish, ling, &c., was given in the statistical tables in the Norwegian Court as 14,587,000 kronor. The exports in 1881 amounted to

	kr.
Klip-fisch	16,012,000
Stock-fisch	6,134,000
Cod roe	1,091,000
Guano	1,335,100
Fish oil	5,438,300
	30,010,400

Or to about £1,750,000, nearly twice the original value of the fish. If it be recollected that these figures only embrace the export trade, and exclude the large number of fish which must be consumed in Norway itself, it is evident that the processes of cure must more than double the value of the fish as it is drawn from the sea.

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* If 200 fish weigh one ton, 375,000 tons would represent 75,000,000 cod.

The cod fishery is the great and important fishery of the Norwegians. But Norway has also a large and productive herring fishery. The history of the Norwegian herring fishery deserves careful consideration from any one interested in the migrations of fish. Till within the last few years, the fishermen mainly depended on the winter herring. Shoals of fish struck the coast between the 58th and 62nd parallels of latitude, and afforded a rich harvest. The fishery, however, had always been a variable one, and the records of Norway prove that, both in the seventeenth and eighteenth centuries, the fish deserted the coast for many years in succession, and that the fishery consequently failed. Such a failure has again occurred in our own time. From 1866 to 1869, 900,000 hectolitres (cwt.) of winter herring were annually taken. The take fell abruptly to 431,000 hectolitres in 1870, to 111,000 hectolitres in 1873, and has never since reached 90,000 hectolitres, or one-tenth of the average annual take in the four years ending 1869. In one year, 1875, it fell to 228 hectolitres only. Fortunately for the Norwegian fishermen, the failure in the winter fishery has been accompanied by a rapid development of the summer herring fisheries and sprat fisheries. In the four years ending 1869 the fisheries only produced 337,000 hectolitres annually; during the seven years ending 1881, they produced on an average more than 900,000 hectolitres of fish.

These figures would be curious enough if they stood alone; but they must now be supplemented with others at least as remarkable. In the years 1860–65 shoals of very large herrings suddenly appeared in the extreme north of Norway, and gave birth to a new fishery; 74,000 hectolitres of these fish were taken in 1866; 446,000 in 1868; 1,056,000 in 1871; but the fishery then fell off to 232,000 hectolitres in 1872, to 448,000 in 1873, and to 382,000 hectolitres in 1874. In 1875 the fish disappeared as suddenly as they had come, and the fishery for the large north herring consequently ceased.

Nothing even in the history of the mackerel fishery of the United States is so remarkable as the variations which have thus taken place in the Norwegian herring fishery. There is no apparent reason for connecting the disappearance of the northern and winter herring with the increase in the summer herring fishery; and there are no means of ascertaining whether the herrings have ceased to visit the portions of the coast which they previously frequented, or whether they have simply, for some unascertained reason, come less near the land than they did before. The latter hypothesis is partly supported by the fact that the Scotch herring fishery has of late years been generally conducted further and further from the Scotch coast. In Scotland this circumstance has tended to throw the fishery more and more into the hands of fishermen who have the largest and the best boats. In Norway the fishermen, fishing only from open boats, and provided only either with hempen seine-nets suitable for use in the fiords, or with hempen drift-nets too short and too heavy for use far out to sea, have been practically unable to leave the land to see whether the fish which have deserted the fiords are still in their neighbourhood; and, in consequence, they are almost wholly dependent on the fish actually coming into the territorial waters to be caught.

If these facts be borne in mind, it seems possible that the favourable conditions which the Norwegian fishermen have enjoyed, and which have hitherto brought large shoals of fish into the fiords to be caught, have actually arrested the development of the Norwegian fishery. Labour, moreover, is so cheap in Norway that the fishermen have had no inducement to adopt those labour-saving contrivances which are used in other countries. Cotton nets, so I was told by M. Brackstad, the Honorary Secretary to the Norwegian Commission, are too dear, and so the fishermen go on using hemp nets. In other words, they are deterred by a small additional outlay from adopting an expedient which would reduce their labour and probably double their catch. In the same way, there is a model in the Norwegian Court of a fish smack, used in carrying salt from Bergen to the Lofoten Islands, and " klip-fisch " from the Lofoten Islands. Her round bows and single square sail make her hopelessly slow, except when she is running before the wind ; and M. Brackstad tells me that she takes three days on a passage which a sharper-built and better-rigged vessel would do in one. But time is of little value in Norway, and no one pays any attention consequently to the circumstance that, by adopting better boats, boats and men would double or treble their earnings. It is on exposed coasts, where fishing is difficult and labour is dear—not in sheltered fiords, where fishing is easy and labour is cheap—that the inquirer who reads the lessons of the Exhibition aright will find the best fishermen and the most healthy fisheries.

The greater portion of the Norwegian herrings are cured. The cure is conducted much in the same way as in Scotland, and the value of the fish is largely increased by the process. According to the tables published by the Norwegian Statistical Office, the value of all the herrings taken in Norway in 1881 amounted to 4,962,000 kronors ; the value of the exported herrings reached 16,393,000 kronors. The value of the fish was therefore raised more than threefold by the process of the cure. Most of the fish so cured are sent to the great German markets, and it may be interesting to add that the Norwegian Government has of late years abolished the brack or brand with which it undertook previously to guarantee the quantity and the quality of the herrings in each barrel so exported.

There are other fisheries of interest in Norway besides those of the herring and of the cod; but there are no others which attain any considerable importance. Salmon, mackerel, and lobster, especially, all yield profits to the fishermen, but the return is small compared with the returns from the cod and herring fisheries; and the cod and the herring produce 93 per cent. of the whole fisheries of Norway. Instead, therefore, of attempting to describe industries which are only of minor importance, I shall, in accordance with the rule which I have followed throughout this report, turn to the fisheries of another country.

HOLLAND.

From a fisherman's point of view there is, in some respects, a remarkable resemblance, in other respects a remarkable contrast, between Norway and Holland. Both countries are inhabited by a race naturally fond of the sea; both of them have the advantages of constitutional government; both of them have, for centuries, devoted themselves to fishing as a serious pursuit; both of them till very recently—and to a certain extent it would be possible to say—both of them still, build their boats on the old patterns, and use the old heavy hempen nets which were used before them by their ancestors. In another respect, however, there is a striking contrast between the fisheries of the two nations. The Norwegians catch the fish close to their coasts. The Dutch go further a-fishing than almost any other people. In the Norwegian Court, however, there were few signs of improvement. It was impossible to go through the Dutch Court without seeing many signs of progress in fishing. Side by side with the old slow-sailing hooker was the modern lugger (the Dutch lugger is, however, dandy rigged), and I am told that these luggers are rapidly superseding the hooker. It is no wonder that they are doing so. Faster and better boats, they catch more fish than the hooker. But the Dutch lugger, fitted for herring fishing, is a very different boat from the English, Scotch, or Manx driver. The British boat measures, perhaps, 15 tons and carries seven or eight men. The Dutch lugger measures 58 tons and carries fourteen men. The difference arises from the different systems pursued in the two countries. In Britain, the boat returns every morning to port to discharge her cargo. The Dutch lugger, on the contrary, remains for weeks together at sea, and cures on board the fish which she takes. It is obvious, therefore, that the Dutch fishermen require a larger vessel than the British fishermen. The new luggers are fine stout boats, a vast improvement on the old hookers, which look like the relics of a previous century of boat-building.

It is interesting to observe, that the wave of improvement which is thus passing over the fishing ports of Holland commenced in 1857, and led to a great development of the fishery. In the five years commencing 1857 Holland had only 90 vessels, and only caught on an average 1675 lasts of herring. In the five years ending 1882 she had 128 vessels, and caught 6626 lasts. In the former period the fleet consisted chiefly of hookers, and each boat caught from 18 to 19 lasts (say 240,000 fish). In the latter period the fleet consisted chiefly of luggers, and each boat caught over 50 lasts (say 650,000 fish). Such figures show tolerably plainly the advantage of improved machinery to fishermen. But there is another lesson to be learned from them. Up to 1857, when the tide of improvement commenced, the Dutch Government protected the fisheries and offered bounties to fishermen. The fishery decayed, just as under a similar system the German herring fishery is decaying now. In 1857 the Government had the wisdom to abolish restrictions and to stop bounties; and the fishery at once prospered. So satisfied was every one with the improvement that, in 1878, the Government took a fresh step, and abolished the brand with which it had previously guaranteed the quality and quantity of the fish. Now that the Norwegian has followed this wise example, the Scotch are the only people who cling to the vicious system of a Government brand.

The herring fishery commences in June and ends in November. During the winter months of the year many of the boats repair to the Dogger Bank for line fishing for cod. "The returns of this fishery have of late years varied between 20,000 and 25,000 barrels, while the export of salted cod amounted in 1881 to 575,000, and in 1882 to nearly 894,000 kilogrammes." In addition, Dutch fishermen catch large quantities of flat fish, chiefly for the Belgian markets, and vast quantities of shrimps, which are chiefly sent to England; 4,311,000 kilos. of flat fish, and 1,178,000 kilos. of shrimps were exported in 1882. (Catalogue, p. 291.)

There is one other industry in Holland connected with fisheries on which it is necessary that I should say something. The Dutch are among the largest and most successful producers of shell-fish in the world. A large proportion of the mussels which are consumed in inland counties in England as food, and which are used in maritime counties in England as bait, arrive from Holland. Oyster culture is almost everywhere a failure; but, amidst a general scarcity elsewhere, the Dutch are succeeding in producing vast quantities of oysters.

The importance of a supply of mussels to the line fishermen of the East coast of England is, perhaps, understood by few people who have not had personal experience in these fisheries. In the port of Eyemouth, for instance, twenty-eight boats were engaged in line fishing in 1882–3. It is estimated that these twenty-eight boats, during the seven or eight months ending May 1883, used no less than 46 or 47 millions of mussels for bait (*see* Mr. Harding's Paper on Molluscs, &c., p. 11). The Eyemouth men used chiefly Norfolk mussels, but many fishermen are solely dependent on Dutch mussels; and 11½ million kilogrammes (say 12,000 tons) of Dutch mussels were imported into England in 1881 (Catalogue, p. 291). In the same year 21,800,000 oysters, about half of which were sent to England, were brought to market.

The circumstances under which oyster culture has revived in the Netherlands were described in an interesting paper read by Professor Hubrecht at one of the Conferences in South Kensington. The oyster fisheries of Holland were originally situated in two places, viz., in the eastern arm of the Scheldt, and in the Zuyder Zee. Up to 1870 the Dutch Government insisted on the observance of a close season from March to October. But, notwithstanding this close season, the oysters failed, and the fish became dear and scarce. The beds in the Zuyder Zee have not since recovered from their depression. The beds in the East

Scheldt have had a much more remarkable history. About 1870, two steps were taken which have affected their fortunes: (1) The Government decided on granting portions of the sea bottom to individual fishermen, and on terminating the public right of fishing; (2) a railway, extended to Flushing, threw a dam across the narrow portion of the East Scheldt, and thus excluded from it further supplies of fresh water. The East Scheldt has been turned into a deep salt-water loch, and the oysters have apparently bred more freely in consequence.

It is reasonable to believe that the construction of this dam has had as much effect on the oyster fisheries of the Scheldt as the termination of the public fishery. But probably the leasing of portions of the ground to private fishermen has had a good effect in stimulating its improvement for the reception of spat. The ground was in the first instance leased in plots from 12 to 150 acres for fifteen years. In 1882, when the fifteen years was approaching completion, the Government decided on renewing the leases. It probably concluded that a fisherman, whose lease was coming to an end, might have an inducement to work out his fishery before the termination of his lease. The results of this policy were eminently successful. In 1870 the 7720 acres which compose the Yerseke bed, as it is called, were let for £1720. In 1883 they produced £28,765. Some attempt was made at the Conference to show that these figures represented what I may, perhaps, call a "fancy" value of the fishery. But there seems no doubt that they were given by practical fishermen acquainted with the ground, who reckoned therefore that it was worth the sum which they consented to pay for it.

Professor Hubrecht stated that scientific fish-culturists in Holland were themselves surprised at the extraordinary quantities of spat which fell, year after year, on the fishery, and which increased its value. Whence did it come? From the time that the ground was taken from the public the close season was abolished; the oysters taken from it were rarely seen to have spat on them; and the fishermen did not leave any masses of oysters for the purpose of securing a spat. Puzzled by these circumstances, specialists set themselves to enquire whether any large oyster beds existed outside the Scheldt from which the spat could have been brought in. Experience, however, proved that such was not the case; and the spat was found to be derived from a different source. The banks of the Scheldt are maintained in many places by stone walls; and the authorities, afraid that these walls might be injured, have prohibited dredging within a certain distance of them. On examination it was found that vast clusters of oysters were aggregated on these walls; and the origin of the spat was consequently explained.

Three conditions, then, have conspired to make the East Scheldt a productive oyster bed. 1. The salinity of its waters has been increased by a dam which has diverted the waters of a river from it. 2. A public right of fishing has been terminated, and a vast number of small leasehold rights have been created. 3. A certain portion of space has been reserved, for reasons which had primarily no connection with oyster culture, on which no dredging whatever has been permitted. Such a history as this ought to be worth more to practical oyster culturists than all the treatises of all the theorists that have hitherto been written on the subject. While in this country we have been ascribing an absence of all spat—or practically all spat—to natural causes connected with the weather, the Dutch, a short distance from us, have secured a spat year after year.

Is it possible to hope that the English may succeed in oyster culture by studying the causes which have led to success in Holland?

No accurate statistics are, so far as I can discover, procurable of the gross value of the Dutch fisheries. Herrings, however, are said to produce from three to four million guelders (say £300,000) a year. An export of 894,000 kilogrammes of salt cod; of 4,311,000 kilogrammes of fresh fish, and 11½ million kilogrammes of mussels, or of 16,705,000 kilogrammes (say 17,000 tons) of fish must have represented a value of £340,000. If 50 per cent. be added to these figures for the consumption of fish in Holland and from the produce of the salmon fishery, the oyster fishery, the anchovy fishery and the minor fisheries, it seems probable that the gross yield of the Dutch fisheries may reach £1,000,000 a year.

BELGIUM.

There is very little in the Belgian fisheries to which it is necessary to refer in the Report. But there is evidence that the Belgian Government is anxious to develop the fishing industry, and that the fishermen themselves are fairly prosperous. The number of fishing boats in Belgium has risen from 175 in 1836 to 318 in 1880. But it is evident, notwithstanding the increase, that the Belgian markets are largely dependent on foreign fishermen for their fish. Ostend, of course, being situated on the sea-shore, would be more easily supplied by Belgian boats than inland towns. But, according to the statistics of Ostend, fish worth 3,468,587 francs were sold in that town in 1882, and more than one-third of this amount, or fish worth 1,261,000 francs were brought to it from foreign countries. The great mass of this fish was brought from England and France; and the author of the Preface to the Belgian Catalogue admits that the Belgians cannot handle the boats as dexterously as English fishermen.

FRANCE.

Belgium had a fair representative collection at South Kensington. France unfortunately was hardly represented at all. The Catalogue, however, contained a carefully written account of the principal French fisheries; and fishing is of so much importance in France that this Report would be incomplete without some detailed description of it.

The French fisheries employ 22,125 ships and smacks, having a capacity of 149,297 tons, and affording occupation to 80,875 persons afloat, and to 55,485 men, women and children ashore. The fishery produced in 1881, 86,917,668 francs; the produce fell slightly in 1882, through the failure of the sardine fishery, to 82,670,058 francs. It is probably then fair to say that the French fisheries are worth from £3,250,000 to £3,500,000; and that France—tested by the value of the produce—stands fourth among the great fish-catching countries of the world.

The principal fishing port of France is Boulogne, whose take is worth upwards of 10,000,000 francs. Fécamp stands second with 5,340,000 francs, Dunkirk third with 4,500,000 francs. Honfleur, Douarnenez, St. Malo, and St. Brieuc, all produce rather more than 2,500,000 francs. The fishermen of these seven ports, therefore, catch fish worth 30,000,000 francs, out of the whole 82,000,000 taken by French fishermen. In respect of value, oysters are the most important produce of the sea. In 1881 the surprising number of 680,372,750 oysters were taken, worth 17,951,114 francs.

These oysters are, in other words, worth about 2 francs 50 centimes, or two shillings a hundred; the low price being due to the circumstance that many of them are only spat or brood, sold to English and other oyster culturists to be laid on other grounds and fattened for market. It would have been a matter of the highest interest if the French had furnished detailed exhibits to illustrate the process of oyster culture in France. But unhappily in this respect, as in other matters, the French section was barren of exhibits. The fisheries for fresh fish, which embraced all kinds of fish sold fresh in the market, realised nearly twice the sum obtained for oysters; 49,940,026 kilogrammes (say 50,000 tons) of fresh fish were taken, worth 32,216,487 francs. Third on the list was the cod fishery of Newfoundland and Iceland. The two fisheries producing 27,378,000 kilogrammes of cod, worth upwards of 13,750,000 francs. The herring fishery, producing 39,101,845 kilogrammes of herrings, worth 9,055,352 francs, ranked fourth in importance.

The nature of the French fisheries, and the distances to which the men go to fish, have affected the character of the vessels employed in the fishery. "The ships used in the cod fisheries range between 100 and 150 tons;" they carry from 18 to 22 hands. Many of them are fitted with steam capstans; they usually carry cotton nets. But most of the nets, and nearly all of the cotton yarn from which the nets are made, are imported from England; and England also sends considerable quantities of fresh fish to the French markets.

HELIGOLAND.

It can hardly be necessary to allude, in a report of this character, to the fisheries of the little island of Heligoland;

and I merely refer to them because a small section of the Exhibition was devoted to this colony; and there is, unfortunately, ample evidence that its fisheries are rapidly decaying. In the present day, indeed, fishing everywhere is passing into the hands of the men who have the best equipped boats; and an island, which has no harbour, and which can hardly be expected to undertake the cost of building one, is not likely to be able to collect a valuable fishing fleet. Heligoland possesses 31 sloops, of one of which there was a model in the Exhibition, and 153 smaller boats. These 184 boats are manned by 307 fishermen, who on an average obtain 171,000 cod and haddock (140 to the hundred) in the winter season, and 20,000 to 30,000 lobsters a year. Such an industry cannot, I fear, be very profitable to the men who are engaged in it.

THE BRITISH ISLANDS.

I turn now to the fisheries of our own islands, which are at once the most difficult to describe, and the most important in the world. The difficulty arises partly from the absence of reliable statistical information, and partly from the variety of the industries. The International Fisheries Exhibition, however, has been the means of throwing a good deal of light on many of the branches of the subject; some of the papers, read at the Conference, have placed at my disposal facts, with which I certainly had no previous acquaintance; and I am able, therefore, to give a more reliable account of the fishing industry than I could have done before.

So far as it is possible to ascertain from the available statistics, there are probably in the British Islands about 37,000 boats, employing either constantly or occasionally

118,000 persons afloat, and 83,000 persons on shore.* But the different kingdoms furnish their boats and men in very different proportions. "England and Wales has one fisherman for about every 600 of its people; Ireland has one fisherman for every 200 of its inhabitants; Scotland has one fisherman for every 75; and the Isle of Man has one fisherman for every 19 of its population. But the figures would look very different if they were applied to particular localities. Of the 42,000 fishermen of England and Wales, nearly one-third, or 13,000, sail from the four great ports of the eastern counties—Grimsby, Hull, Yarmouth, and Lowestoft; nearly one-sixth, or 6000 sail from the great Cornish and Devonshire ports—Penzance, Falmouth, Fowey, Plymouth and Dartmouth. These nine ports, therefore, supply nearly one-half of all the fishermen of England and Wales. The whole coast line of Wales does not support so many fishermen as the single town of Lowestoft or the Isle of Man." ('British Fish Trade,' pp. 7, 8.)

These figures are, I believe, calculated on a moderate basis. In the fisheries of the United States, and other countries, allowance is made for the men who are engaged whale fishing, seal fishing, or in kindred industries. No such allowance is made in the numbers which I have set out in the foregoing paragraph. It has never been the custom in this country to include whalers and their crews as sea fishermen. Again, in the statistics of the United States, the number of men employed fishing in fresh waters or fishing for salmon are included. These two classes of persons are, as a general rule, excluded from the above statistics; and, in any comparison made between the fisheries of America and of our own islands, this circumstance should be borne in mind by the statistician.

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* I have followed in the text my own calculation in my manual on the 'British Fish Trade,' p. 7. The Duke of Edinburgh has given some slightly different figures in 'Sea Fisheries and Fishing Population,' p. 22.

There are three great classes under which the sea fisheries of the British Islands may be grouped. They are 1. The trawl fishery. 2. The drift-net fishery. 3. The line fishery. On each of these I propose to say a few words.

The Duke of Edinburgh in a valuable paper, which was read at one of the earlier conferences, estimated the quantity of fish caught by trawlers in one year as follows:—

English Trawlers	211,707 tons
Scotch "	762 "
Irish "	2,688 "
	215,157 tons

and, placing the price of trawled fish at £12 per ton, he computed the total earnings of our trawling fleet at £2,581,000 a year ('See Fisheries and Fishing Population,' p. 38). But, in a later paper, Mr. Ansell—a gentleman engaged in the trawling trade, whose paper displays the knowledge of a specialist—said, that, without including steam cutters, the number of British deep-sea trawlers may be taken at 3000. "Taking the average catch of each of these at 100 tons, brings the total weight to 300,000 tons," the money value, if it be placed at £10 a ton, will reach £3,000,000," or, at the Duke of Edinburgh's estimate of £12 a ton—an estimate which I am inclined to prefer—£3,600,000.

This sum, it must be observed, does not include the value of the smaller trawlers, which work the coasts, and are called inshore trawlers. It may be assumed, therefore, that the estimate is moderate, and that the trawlers annually produce from £3,000,000 to £3,600,000 of fish food for the great markets. The chief trawling stations are, of course, on the shores of the North Sea. But trawling takes place almost all round the coasts of England; it is now extending into Scotland. The trawl is also used—though to a limited extent—off the Irish coasts.

Trawlers are built of every size. The large trawlers of Grimsby and Hull run to 70, or even 90 tons, and carry five, six, or even a greater number of hands. The capital of a deep-sea trawler fitted for sea may be computed at about £1500, some of the boats are worth more; and it may therefore be assumed that some £4,500,000 is embarked in the industry, and that it affords constant employment to 15,000 persons.

The drift-net fishing is of almost equal importance. It consists chiefly of the great herring fishery, which is the great staple of the Scotch fishery, but in which English, Irish, and Scotch fishermen also engage. In my manual on the British fish trade, I stated my reasons for concluding that British fishermen annually captured 2,000,000,000 herrings. If these fish were only worth a farthing a piece, the value, I pointed out, must exceed £2,000,000 (p. 35). The Duke of Edinburgh, in the pamphlet which I have quoted, has placed the take at 1,650,000,000 fish, but he has apparently excluded from his calculations the Irish take, which would raise his figures to about 1,700,000,000 fish. He has, however, placed the value at £12 a ton, or, if 5500 fish go to a ton (and His Royal Highness estimates a ton of fish to comprise 5500 fish), at about one halfpenny a piece. According to his figures, therefore, the value of the herring fishery amounts not to rather over £2,000,000 a year—as I have estimated it—but to £3,600,000. In this place I will take the mean between the two calculations, and assume the produce of the fishery at £2,800,000. The value of the kindred fisheries for mackerel, pilchards, and sprats, cannot be less than £200,000, and probably reaches £350,000 a year. It may, therefore, be assumed that the produce of the fisheries, which are chiefly conducted by drift-nets, reaches £3,000,000; and that the produce of the trawl fisheries and drift fisheries together amounts to £6,600,000.

I have still to consider a much more difficult subject—the value of the great line fishery. Fishing with long lines continues, and will apparently long continue, a large and profitable industry. The cod smacks, which sail from Grimsby, are always the largest and most valuable vessels employed in the fishing trade. "Those built of late years," said Mr. Mundahl, in a paper which he read on line fishing (p. 13), vary from 70 to 85 tons, and we have some of 120 tons register. The usual dimensions are 65 to 70 feet length of keel, 20 to 21 feet beam, and 11 feet to 11 feet 6 inches depth amidships; in ordinary ballast trim they draw about 11 feet of water aft, and from 7 to 7½ feet forward. . . . The master and five men occupy the cabin, and four to six boys the forecastle. In the centre of the vessel a space of nearly one-third the length of the keel is set apart for the well: this is divided off by strong bulkheads or well-heads, as they are termed, of oak, 12 to 14 inches thick; the space so set apart is again divided by one or two sectional bulkheads, thus forming two or three wells, as the case may be. . . . The smack carries with it a boat about 20 feet in length, 6 feet 4 inches in width, and 3 feet in depth." A smack of about 80 tons register costs ready for sea from £1600 to £1800. At present there are about 120 cod smacks at Grimsby alone.

It is obvious that a vessel, in which so large a capital is embarked, and which affords employment to so many hands, must earn a very considerable sum of money. In the struggle for existence, the cod smack would soon disappear, if each smack did not catch on an average 100 tons of fish a year. The 120 Grimsby smacks must, in this case, catch 12,000 tons of fish; and it may, therefore, be assumed that the Duke of Edinburgh's estimate that the line fishermen of the kingdom catch 51,000 tons of fish a year, is a moderate one (See 'Fisheries and Fishing Population,' p. 47). Line-caught fish are the most valuable which are brought to market, and command a special price of their own. If their value be only equal, however, to that which His Royal Highness has assumed as the value of other fish, or £12 per ton, line-caught fish must yield to the fishermen upwards of £600,000 a year.

The three great branches of sea-fishing—trawling, line-fishing, and drifting—in all probability produce £7,200,000 a year. Competent authorities place the value of the salmon fisheries at £900,000 a year; other analogous fisheries, those for eels, twait, and shad, certainly yield £100,000; while, in another pamphlet, I have given my reasons for thinking that the fisheries for molluscs and crustacea yield some £2,000,000 annually ('British Fish Trade,' p. 45). Without, then, taking into consideration the whale and seal fisheries—I see from a paragraph in the newspapers, while I am writing, that the earnings of the Dundee fleet alone have amounted to £207,000 during the recent season—I believe it to be a reasonable and moderate assumption to place the value of the fisheries of the British Islands at £10,000,000 a-year.*

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* In the preceding account I have endeavoured to correct the estimate which I published in the 'British Fish Trade,' or rather to supplement it by the additional information which has been obtained at the Fisheries Exhibition. I have not entered into an elaborate description of the British fisheries, because I have already given such an account of them in the pamphlet thus referred to.

GENERAL CONCLUSIONS.

I have thus endeavoured to give a short and general account of the fisheries of some of the principal fishing countries of the world. I am aware that my description is far from complete; I am aware also that I have omitted to add to it any account of the fisheries of other countries, such as Chili, Switzerland, Haiti, or Venezuela, which were, more or less satisfactorily represented at the Exhibition. But I have been obliged, in the first place, to confine this portion of my report to the investigation of the interests which a few countries possess in the fisheries of the world; and I have been obliged to exclude from it all reference—except the most incidental allusions—to communities whose fisheries were of no interest to practical fishermen. In the space which is still left to me, however, I propose to offer a few general remarks on the preceding matter, and on the lessons which the Exhibition itself is apparently calculated to impart. I am aware that, in doing so, I am moving on even more dangerous ground than that on which I have previously travelled. But, I think, that it would be a serious misfortune if no attempt were made to deduce some general conclusions from an exhibition of such a character as that which has been held in South Kensington; and, incompetent as I may be for the task, I shall accordingly attempt to discharge a duty which otherwise may not be performed at all.

(1). VALUE OF FISHING.

The first general reflection which suggests itself to any one who has made a careful study of the collections at the Exhibition, is the vast importance of the fisheries of the world to the nations which engage in them. The allegations, indeed, which are occasionally made, that an acre of water produces more food than an acre of land, are only true in a very different sense from that in which they are usually accepted by publicists. There are limited areas of sea, estuary, lake, and river, which are much more productive of food than corresponding areas of equal size under either wheat or any other crop. But there is no large area of sea-bottom which produces anything like the food produced by corresponding areas of land. Take, for instance, the Dogger Bank, which is probably the most productive portion of sea-bottom in the world. The Dogger Bank covers about 4,000,000 acres. It would be a very liberal computation to suppose that the Dogger Bank yielded fish worth £5,000,000 a year. But 4,000,000 acres of agricultural land, if it were only let for £1 an acre, would produce at least three rents, or food worth £12,000,000 a year. Though, then, it is true that certain restricted areas of foreshore and sea bottom, where particular fisheries may flourish, are more valuable than corresponding portions of land, the allegation that the sea produces more food than land, is not true in any general sense; and, like all exaggerations of the truth, is calculated to lead to disappointment.

The true value of the fisheries of the world cannot be even approximately stated. But the value of the fisheries of certain countries may be stated with some approach to accuracy. It may be asserted with confidence that the British Islands head the list, and that British fishermen draw at least £10,000,000 from the seas which surround these islands. The fisheries of the United States, it may be asserted with equal confidence, follow in the second place with a take worth £8,660,000. It will probably surprise most persons to learn that Russia occupies the third place with a produce of £5,250,000. If, indeed, the fishing produce of these three great nations were measured not by value but by weight, it is not clear that Russia would not be entitled to the first place on the list. Her fishermen draw 600,000 tons of fish from Russian waters. It may reasonably be doubted whether, if the shells of shell-fish be excluded from the calculation, either the United States or the British Islands obtain a similar amount of food from their own waters.

These three nations, then, occupy the foremost place among the fishing communities of the world, and the superiority which British fishermen have secured, and which they still retain, is not so marked as perhaps some persons may imagine. The eloquent words, indeed, in which M. de Tocqueville alluded to the growth of the United States and Russia might be applied literally without change to the fisheries of these countries. They "have grown up unnoticed. . . they have suddenly assumed a most prominent place among the nations; and the world learned their existence and their greatness almost at the same time."

With the exception of these three great countries, no nation in the world draws £5,000,000 a year from its fisheries and kindred industries. Canada probably draws £4,000,000; France, £3,500,000; Italy, £1,600,000; Spain, £1,400,000; Norway, £1,300,000; Newfoundland, £1,250,000; and Holland, £1,000,000, from fishing. It may be doubted whether any other nation or colony—unless China and the East Indies be an exception—draws £1,000,000 a year from the waters of the ocean.

These figures would give a very imperfect idea of the value of the fisheries if it were not added that, except in the case of Newfoundland, they apply to the value of the fish drawn from the ocean, and not the value of the fish ready for market. The Americans estimate that the value of the fish is more than trebled by curing and other processes. The value of the fish exported from Norway is two and a half times as great as the value received by the fishermen; and as, in addition, there is a large local consumption, the value of the fish after it is cured must be three or four times as great as its value when it is caught. Other instances might be given of the same fact; and it will probably be found that the price paid for fish either by the exporter or the consumer is at least three times the price paid for fish to the fishermen.

It will probably surprise many persons to learn that oysters are in all probability the most valuable product drawn from the ocean. It has been shown that in the United States alone the oyster harvest is worth £2,750,000, while in France it is worth upwards of £700,000 a year. The oysters of these two countries, therefore, yield to the fishermen £3,450,000. Professor Huxley alluded in his inaugural address to the influence which the Phœnician fishery for a little mollusc, a kind of dogwhelk, had exerted on the history of the world. Perhaps the demand for this little shell-fish, valuable for the purple dye which it contained, did more to stimulate the growth of maritime enterprise than any other circumstance which has come down to us. The dogwhelk has long since lost its value, and is destroyed by the fishermen, who think it hurtful to the oyster. But another mollusc, the oyster, has become the object of a greater trade than any Phœnician city ever enjoyed. Its capture employs men by the ten thousand; its culture is the subject of anxious thought and of constant experiment; and in various forms, raw, cooked, and tinned, it supplies man with vast quantities of valuable and nutritious food.

If oysters are the most valuable product drawn from the sea, cod are the most valuable fish drawn from its waters. The cod caught by American, Canadian, Newfoundland, French, Dutch, and Norwegian fishermen, are worth £4,200,000 a year. Even the herring fishery, which ranks probably next in importance to the cod, is not of such importance; while salmon, though they fetch high prices in the markets, do not probably produce so much money to the fishermen, and certainly do not produce so much food for the public as the more homely cod. There was, therefore, truth as well as wit, in the saying in the play,—

> "She that in wisdom never was so frail
> To change the cod's head for the salmon's tail."

I have mentioned these few facts because they are not generally known, and people do not realise the importance of oysters, cod, salmon, and herring in the harvest of the sea. It is perhaps necessary to add that the oyster and salmon fisheries are conducted frequently by a different class of men and in a different class of vessels from those in which the cod and herring fisheries are worked. The best oysters are usually caught in sheltered bays; salmon in rivers or in estuaries; and the fishermen who conduct the fishing are not exposed to the same dangers as the hardy sea fishermen who frequent the Banks off Newfoundland, or who explore every portion of the waters of the North Sea.

(2). RACES OF FISHERMEN.

In the production of sea fishermen of the highest type there are two nations in the world—the British and the Americans—who are far in advance of all other people

The Dutchman, the Swede, the Dane, the Frenchman, and the fishermen of a few other countries go far away from their own shores for the sake of fishing. But none of these nations have the instruments and labour-saving appliances which have made the British and the Americans the most successful deep-sea fishermen in the world.

I have observed in another pamphlet that all parts of the British Islands do not produce successful deep-sea fishermen. Broadly speaking, the east coast of Great Britain, the counties of Devonshire and Cornwall, and the Isle of Man furnish all the fishermen who in these islands make deep-sea fishing the chief or only pursuit of their lives. Boats from these places may be found engaged fishing in almost every portion of the British Seas, while Irish boats are rarely or never seen, and Welsh boats never seen in their company. It is remarkable, too, that this class of men is distinct from the ordinary seamen. The best fishermen adhere to fishing, and do not join the Navy or enter the Mercantile Marine. In some places they readily join the Naval Reserve; but in few instances, except as reserve men, are they willing to join Her Majesty's Navy. Whether I am right in assuming that they have inherited their love of fishing from their ancestors, I will not attempt to decide now.* But I desire to point out that my conclusion has received an unexpected corroboration from the experience of the United States. In that great country, in which the representatives of almost every people may be found, men of many nations and of various origin are engaged in fishing. The native Indians carry on the salmon fishery of the Western States; the Chinese coolies furnish factory hands in the canneries of the Sacramento; the liberated negro engages in the shad fisheries of the Southern States and the sponge fishery of Florida. But, writes Professor Goode, "considerably more than one-half of the fishing population of the United States belongs to the Atlantic coast north of the Cape of Delaware; of this number at least four-fifths are of English descent. They are by far the most interesting of our fishermen, since to their number belong the 20,000 or more men who may properly be designated the 'sailor fishermen' of the United States—the crews of the trim and swift-sailing vessels of the sea-going fishing fleet, which ought to be the chief pride of the American marine, and which is of such importance to our country as a training school for mariners, and as a medium through which one of the most valuable food resources of the Continent is made available" ('Fisheries of the United States,' p. 25). Race may or may not have much to do with the comparative importance of the English and Irish fisheries. But the argument for race influence is strengthened when it is found that the same stock, which furnishes the best fishermen in Europe, furnishes exclusively the best fishermen in the United States.

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* I have stated my conclusions on this subject in the 'British Fish Trade,' pp. 4, 5.

It may, perhaps, be thought that the original immigrants from England enjoyed an advantage over those from other countries, because they were acquainted with the most efficient modes of fishing. Handing down the results of their own experience to their sons, they may, in this way, have created a race of fishermen. But it may be answered that, though the United States and England are in advance of all other communities in fishing, they adopt, as a rule, contrary modes of catching fish. Both nations use the long line, indeed; but, with this exception, the chief instruments used in England have no counterpart in the United States. The British fisherman uses the trawl and the drift-net; the deep-sea fisherman of America uses the purse-seine. The men of both countries have brought the art of fishing to the most perfect condition in which it is found on the globe. But they pursue contrary methods, the result probably of their own experience, and which cannot have been handed down to them from a common ancestry. The non-introduction of the beam-trawl into American waters may probably be partly explained by the circumstance that the American seas, otherwise rich in fish, are poor in flat fish. The Americans, for instance, have not got the common sole. They have not, therefore, the fish to catch which it was the object of the earliest trawlers in this country to catch, and the harvest which they annually draw from the seas consists chiefly of fish which would not be caught by trawls in this country. But the fish which are caught in America by the purse-seine are in this country caught by the drift-net; and the Exhibition will not have been useless if it lead to a thorough investigation of the reasons which exist for this difference, and induce practical men on both sides of the Atlantic to determine whether either the drift-net can be usefully introduced into American or the purse-seine into British waters.

(3). FISHING VESSELS AND FISHING INSTRUMENTS.

It may, indeed, be possibly thought that the boats used by fishermen in England are constructed with a view to the use of the drift-net, and are not so well adapted as the large fishing schooners of the United States to the use of the purse-seine. A seine-net requires to be worked from small boats carried to the fishing grounds on the fishing vessels; and, large and roomy as the first-class drift boats of Scotland and the Isle of Man now are, they clearly have not deck room to carry boats of the same size as the schooners of the United States. Men, however, on whose practical experience I can rely, are of opinion that there is no reason why two drift boats, working in company, should not carry men and boats sufficient for the working of a purse-seine. On this point, however, it may be desirable to say a few words as to the fishing vessels of the two countries. In both countries a change of a radical character has been effected during the lifetime of a generation in the construction of fishing boats. In both countries the tendency has been to build larger and faster vessels. The change which has thus taken place in the United States was admirably illustrated by the collective exhibit of the United States Commission of models of boats used in the past and used now in the United States* (Catalogue, p. 197, No. 84). The change which has taken place in our own country could only be inferred from a more careful inspection of the models of individual exhibitors. But, in the Isle of Man section, one builder (Catalogue, p. 132) showed excellent models of the old lugger which used to be employed, and which is still employed in the herring fisheries, and of the new dandy, by which it is being fast superseded. The difference, however, between the size of the vessels of the two countries is remarkable. The new three-masted schooners which are built for bank fishing in America are 105 feet in length over all, and 88 feet in length of keel. The largest and best drift boats in the British Islands have 50 feet keel.

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* The most striking boats in this exhibit, in an historical sense, were (1) the "Chebacco" boat measuring about 17 tons, representing the best boats in use in the early part of the century; (2) the "Pinkey' measuring some 35 to 40 tons, the best boat in use from 1820 to 1840; both of which formed a striking contrast to the fine schooners now in use (Catalogue, p. 197). "This collection," wrote the Jury, "shows in a very interesting and instructive manner the gradual development of the American fishing schooner, during the last 50 years, from the blunt-bowed and heavy square-sterned vessel of 1830 to the extreme clipper of the present day."

It does not follow from the greater length of the American vessels that they are the better boats. I speak with deference on a subject which is eminently one for a specialist; but I believe that the most competent Americans were themselves struck with the greater draft of our own vessels, and with the greater stability which they in consequence possess. The large three-masted schooners, 105 feet in length—the latest development of American industry—draw only 9 feet 9 inches. But in this country an ordinary herring boat with 50 feet keel draws 8 feet 6 inches. A boat of the length of the American schooner would draw 12 feet, or nearly 12 feet, of water.

There is another remarkable distinction between the American boats and our own which is worth observing. In America—at any rate, before the menhaden fishery went into steam—there was only one type of vessel in use. In the British Islands almost every locality has its own type of boat; while different kinds of fishing are always conducted in different kinds of vessels. The line smacks, the trawlers, and the drift boats, sailing from the same ports, are all specially designed for the particular industries in which they are intended to take part. No doubt efficiency is secured by the distinction. Every vessel is specially designed for a particular industry. But this very circumstance may probably make the introduction of the purse seine a more difficult matter than it would otherwise have been. A vessel built for drift fishing alone is less likely to be adapted to the seine than a vessel constructed for every mode of fishing.

This reflection, moreover, leads to another. The changes which are now being made in fishing vessels in this country are not perhaps favourable to the introduction of a new mode of fishing. In the United States it has been shown already that one important branch of the fishing trade—the menhaden fishery—is conducted in steam vessels. When fishing for menhaden commenced, in 1856, the fishermen embarked in sailing vessels alone. In 1866 the first steamer was built for the fishery, which is now conducted almost wholly in steam vessels. There are indications that the same change is likely to take place in this country. Steam trawlers have, for some years past, been working on the East coast of England. The vessels, however, so employed have not as a rule been built for the purpose. They are not therefore particularly well adapted for the object; and it is perhaps a remarkable, and not very satisfactory fact, that the steamers which obtained a special prize for fishing purposes were models of vessels built by a Scotch firm (Messrs. Allan), but used by Spanish fishermen (Catalogue, No. 93). More excellence was attained in the models of steam fish-carriers, or in vessels used in carrying the fish from the fleet to the markets; and the boats shown by Messrs. Sims and Toozes (Catalogue, No. 79), which gained a special prize of £52 10*s*., deserved the praise which the Jury awarded them. The same firm was successful in obtaining another special prize of £15 for a sailing trawler, fitted with a steam capstan for raising the trawl.

So far then as trawling is concerned, it seems clear that the finest and best trawlers employed are sailing vessels, and that steam is likely to be used in the trawling fleet chiefly for aiding the fishermen to raise the trawl, and of course for carrying the fish caught to and from the markets. The best trawlers on the East coast of England are fitted with steam capstans. In the same way there is apparently no immediate probability of steam being used as a motive power in the drift fleet, but the best drift boats are rapidly providing themselves with steam capstans to aid them in the heavy work of hauling in the nets. Several makers exhibited capstans of this character. Most of them were built on the same principle; though the price of them varied from £135 to £80. The advantage derived from their use is very great. It enables an ordinary herring-boat to be worked with seven instead of eight hands, and it alleviates the toil of the remaining seven. As it does not cost so much to supply a small engine of this kind with fuel as to feed a man, the profits of the boat are increased by its use. It must, however, be evident that the fact that the finest boats are already fitted with these capstans tends, as far as it goes, to discourage the introduction of the purse seine. The capstan would be useless for the seine net, and the capital paid for it would therefore be thrown away.

As a general rule, then, it may be stated that the boats employed in British fisheries seem specially designed for the particular industry in which they are engaged; and ill-adapted, or imperfectly adapted, for other modes of fishing. The purse seine may ultimately supersede the drift net; but it is probable that, should it do so, it will concurrently lead to the construction of a new type of vessel. Perhaps, if the seine should win the day, it is desirable that the present drift boats should fall out of use. The safety of the fishermen working it will largely depend on the sea-worthiness of the small boats employed in the operation: and, as these will have usually to be carried to the fishing grounds on deck, it is obvious that the larger the vessel used, the larger will be the boats which she will be capable of carrying. This, however, brings me naturally to consider the loss of life which annually takes place among fishermen. His Royal Highness the Duke of Edinburgh, in the paper which he read before the Conference, has investigated this subject in a manner which does credit both to his heart and to his head, and I cannot do better than make one or two observations on His Royal Highness's conclusions.

(4). LOSS OF LIFE AMONG FISHERMEN.

A loss of life among fishermen arises from two causes. Fishermen are, in the first place, liable, like all seafaring men, to the dangers which are inseparable from a mariner's life; and these perils are, to a certain extent, aggravated by the temptation, under which all fishermen lie, to run for port to dispose of their fish; and port in these cases is unhappily too frequently a harbour which it is dangerous to approach and impossible to enter except at certain states of the tide, while, in Kingsley's words, "the foam on the bar is moaning." Every now and then some sudden and severe storm catches a fishing fleet on its return to port, and sweeps many brave men to a watery grave. Lamentable, however, as such a loss of life is, it is remarkable how few men, on the whole, meet with their death in this way. According to the Duke of Edinburgh, the whole loss of life in Scotland among fishermen amounted in two years to only 1·8 per 1000 of the whole number of fishermen. The chances, therefore, of a Scotch fisherman being drowned are not greater than the chances of his death from zymotic diseases, and are not nearly so great as the chances, which every coal miner incurs, of death from a colliery explosion.

Without, then, in any way detracting from the gravity of these figures—with an earnest wish, on the contrary, that steps may be taken, by the construction of better harbours, to reduce the death roll—it does seem essential that the public should understand that the loss of life from such causes as these is not comparatively speaking great. Every now and then, no doubt, a disaster occurs, which arrests the public attention and excites the public pity, by which a score or even more of brave men are swept into eternity. But, as a rule, the boats are so well found, their crews are so skilful, that the losses occur at rare intervals. There is, however, another cause of loss of life of which the public never hears, but which is much more worthy of attention. For every man lost in consequence of a casualty to a fishing vessel, probably five men are drowned in the North Sea without any such casualty occurring. Two of the chief dangers to which fishermen are exposed lie in ferrying fish from the trawler to the carrier in small boats, or in laying out long lines from the fishing smacks in small boats; and the greatest benefactor to fishermen will not be the man who makes the trade of fishing vessels less profitable, but the man who devises some remedy for what, without exaggeration, may be called these hideous dangers.

These dangers, as I have indicated, are twofold. In long lining the lines are laid from the small boats which are carried by the smacks. There is constantly a heavy sea on the banks; a small boat is easily upset; and the men, generally dressed in heavy clothes and heavier boots, are drowned. Exactly the same thing occurs in ferrying fish from the trawler to the carrier. The fish are carried in small boats from the one to the other. The boats, to save frequent journeys, are heavily laden; they are upset, and the men are drowned. The Duke of Edinburgh's paper enables me to state the loss numerically. In Scotland, which is the chief home of the drift fishing, 11·83 casualties to every 1000 fishing vessels occur annually; and, as I have already stated, 1·8 out of every thousand fishermen are drowned. But in England, while the casualties amount to 11·39 for every thousand fishing vessels, the loss of life is 7·55 for every thousand fishermen. In other words, while the casualties in England are rather less numerous than in Scotland, the loss of life is four times greater. But these figures, frightful as they are, do not represent the whole state of the case. On the west and south coast of England, from the Solway Firth to the Straits of Dover, the loss of life among fishermen does not materially exceed the rate in Scotland. It amounts to 1·84 per thousand; and the whole amount of the excess arises on the East coast of England, where the loss of life amounts to 10·475 for every 1000 fishermen engaged.

This loss of life does not arise from any defect in the fishing vessels. On the contrary, the casualties to fishing-vessels in this portion of the coast, 10 per thousand, are less numerous than those to fishing vessels in Scotland. It is solely due, according to the Duke of Edinburgh, to the danger of ferrying fish from the trawler to the carrier, and of laying the long lines in small boats.*

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* I have given in the text His Royal Highness's conclusions. The figures, which he has worked out with great care, are in 'Sea Fisheries and Fishing Population,' pp. 22–26. It is perhaps right to point out that the returns published in the 'Report of the Sea Fisheries Trade Committee, 1883,' throw a somewhat different colour on the figures. These returns (which will be found in the Appendices, pp. 175–179) refer only to two ports, Hull and Grimsby; and it would be a matter of extreme interest and importance if similar returns could be obtained for the whole country, and if they could be carefully analysed by some competent person. If human life has the value which most people attach to it, it surely cannot be beyond the province of Her Majesty's Government to appoint a small Commission to ascertain the reason why the loss of life among English fishermen is four times as great as the loss of life among Scotch fishermen.

Those who had a knowledge of these circumstances, which have been brought out by the Duke of Edinburgh for the first time in their full force, saw with pleasure that a gentleman had offered a prize of £60 for the "boat best adapted for carrying fish from the catcher to the carrier." His humane object in offering the prize was evident from the condition attached to the offer—that no prize should be "awarded unless the boat is specially adapted for preserving the lives of her crew." But those who anticipated that the best results might ensue from the liberal offer will be disappointed to learn that, in the opinion of the Jury, no model exhibited displayed the degree of ingenuity and inventiveness in the particular type which might reasonably have been expected." The Jury accordingly did not feel justified in awarding the prize; and perhaps one of the highest and best results—which it was hoped that the Exhibition would secure—was thereby lost.*

It is obvious that, if the Duke of Edinburgh is right in attributing the exceptional loss of life on the East coast of England to the circumstance that in trawling and lining the fishermen leave their vessels, and enter small boats, the comparative safety which the herring fishermen enjoy will be lost if the drift-net should be superseded by the purse seine. The fisherman will be compelled to ply his trade from a small boat, and not from the deck of his vessel. This danger is not likely to interfere with the introduction of the purse seine. Men will always be found ready to risk their lives in any profitable calling, but the prospect increases the desirability of discovering some small boat, which an ordinary fishing vessel can carry, and which is incapable of being swamped, or, if it be swamped, of being sunk at sea. It ought not to be beyond the capacity of men—who have already invented a life-boat—to devise such a boat. The man who does so will be the means of saving brave and valuable lives every year.

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* The Jury has expressed a hope, however, that the prize may be held over for a short time, as they think that, if time be only allowed to consider their views, the model will be forthcoming.

(5). FISHING GEAR.

I have been hitherto considering the possibility of the drift-net being superseded by the purse seine; I come now to a different portion of my subject—the possibility which the Exhibition has held out of improving any of the existing modes of fishing in use in England—and, first, as to the drift-net.

Drift-nets are made of various materials—hemp, flax, and cotton being the chief substances. But there was apparently a general agreement that nothing in the Exhibition, and nothing produced in any foreign country, was superior to the cotton thread which is now almost exclusively used in their manufacture in England. The cotton nets, however, are attended with one disadvantage. Their lightness has enabled the fishermen to increase the length of net carried by each boat, and the boats now frequently ride to nets which are from 1½ to 2 miles in length. The nets so used are fastened on to the head-rope, and secured to the bottom rope; and, in consequence, when a heavy take of fish is being drawn into the boat, the strain on the net itself is very great. Another difficulty also arises where drift-nets are fishing in the neighbourhood of trawlers. If a trawler fouls a drift-net, it is frequently compelled to cut through the drift-net, or, at any rate, cuts it accidentally, and large quantities of nets are in this way annually lost. Messrs. Corrin, of the Isle of Man, exhibited a model net intended to lessen this inconvenience. They propose to reduce the length of each length of net from 60 to 33 yards, and to mount each net all round with ropes, attaching these ropes, and not the net itself, to the bottom and the head ropes. Messrs. Corrin allege, from practical experience, that nets so mounted sit better in the water and catch more fish than nets mounted in the ordinary way; that they are stronger, and therefore enable the fishermen to go on fishing in weather when the strain on the ordinary net would be liable to tear it; and that, in the event of their being fouled by either trawlers or passing vessels, the loss is reduced to a minimum, being confined to the single 33 foot length of netting. The Jury said of this excellent contrivance that as they "had only a drawing before them, and were not *all* satisfied that the invention was new," they "did not award any special prize for it;" but they added that they could not "help saying that it deserves the careful attention of all fishermen." So far as my own knowledge goes, which is more limited than that of the Jury, it seemed to me one of the most important improvements in netting which the Exhibition has been the means of communicating to practical fishermen.

It is, indeed, a remarkable fact, indicative either of the conservative habits of net-makers, or of the excellence to which they have already attained, that the Jury were unable to find any drift-net exhibited which embraced all the qualities required for the Special Prize for apparatus and gear complete for a drifter: and that they similarly felt bound to withhold the special prizes (1) for a collection of bowls, buoys, and bladders, for drift and surface fishing; (2) for a mounted herring-net, and (3) for a mackerel-net.

Much the same thing may be said of the trawl-net. Writing, as I am, for persons with some knowledge of fishing, it is, perhaps hardly necessary to explain that a trawl-net is a long purse-like net, the mouth of the purse being kept open by the attachment of one side of it to a heavy beam, which, in its turn, is raised from the bottom by some heavy iron sledges or trawl-ends. The trawl is dragged along the bottom of the sea on these trawl-ends; and it is a common allegation that, in consequence, everything—fish of all sizes and spawn of all sorts—is swept into the net, and the fisheries consequently ruined. These allegations, exaggerated into complaints, have frequently engaged the attention of Her Majesty's Government, and been made the subject of exhaustive investigations by Commissions of Inquiry. But, though the Commissions have, one after another, reported in favour of the trawlers, the opponents of trawling have never rested satisfied with their defeat. They have from time to time renewed their complaints; and, at the present moment, a new Commission—the third in twenty years—is investigating them on the coast of Scotland. Under these circumstances, considerable interest was excited by the fact that the Mayor and Corporation of Yarmouth offered a very handsome prize (£52 10*s.*) for a model or specimen of an improved trawl-net capable of allowing immature fish and refuse to escape therefrom. But the liberal offer unfortunately produced no results. The Jury reported with regret that they were unable to find among the many exhibits any net entitled to the special prize; and it may be presumed, therefore, that the trawl will be permitted to go on trawling in the old way, and, be they good or evil, with the old results.

It does not appear, then, that the Exhibition has done much to introduce any practicable improvement into either the trawl-net or the drift-net, the two engines chiefly used by British fishermen. It is not clear that it may not lead to more important results in line fishing. Foreign line fishermen, indeed, practically pursue the same modes of fishing which are used in this country. But it does not seem certain that the large glass buoys in use in Norway to buoy the line, and the smaller glass buoys used to keep each individual bait off the ground, are not cheaper, better, and more durable than the buoys used in this country. I have long thought, moreover, that the labours of our line fishermen—indeed of all our fishermen—would be lightened by the introduction into this country of the simple instrument which the Americans call "a nipper." "Any one who has had hold of a wet line in cold weather, knows how the hand is chilled, and perhaps cut, by the slippery hemp on which it is difficult to maintain a secure hold. To give them a secure hold of the line, the American fishermen use what they call nippers. The nipper consists of two rings of flannel, each ring about the size of a small quoit, bound tightly round with knitted wool. The two rings thus made are sewn firmly together, and of course when the two are joined, there is a depression in which the line rests. The fisherman, instead of grasping the line, grasps the nipper, which closes on the line and holds it tightly; and the fisherman, instead of hauling a wet slippery line, holds a warm, dry, woollen, double ring. I am assured, and I can easily believe, that this simple invention increases the fisherman's strength fourfold. It must increase his comfort, at least, as greatly; and though these nippers have not found their way into the Official Catalogue, they seem to me as well worth the attention of fishermen of other nations as many more prominent and more noticeable articles." *

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* The extract in the text is taken from my Report on the 'Berlin Exhibition' Inspector's 20th Annual Report, p. 11.

(6). FISH-CURING, &c.

I pass now from the general question of catching fish to the modes of curing fish. If the British Islands are in advance of most, if not all, other nations in the art of catching fish, they are certainly behind many nations in the art of curing them. The various modes of preparing fish which are resorted to in America, Norway, and other countries, are unknown in England, and except that in Scotland cod are salted and herrings pickled; and that in England herrings are converted into red herrings, kippers, and bloaters; and that in both countries haddocks are kippered—the art of curing fish is strangely neglected. No doubt this arises in some degree from the circumstances of the people. There is no country in the world where there is so large a consumption of fresh fish; there is, therefore, no country in the world where it is so easy to obtain a market for fresh fish; and the fishermen are able usually to sell their fish without, in the first instance, curing them. This, however, is not universally the case. The majority of Scotch herrings are pickled for exportation. Large quantities of sprats are sold for manure, because they cannot be sold as food; and Cornish pilchards are, of course, rarely sold fresh, the mass of them being pickled.

In making these remarks I have not omitted to observe that a British exhibitor (Messrs. Moir) obtained the special prize for the best collection of canned fish. But they were fish which were almost, if not exclusively, imported from other countries, and the fact, therefore, of a prize being awarded for them has no bearing on the general question of the inability of the British to cure fish. Nor will I endeavour to determine whether ingenuity has been dulled and improvement checked by the existence in Scotland of a Government standard of cure, which has undoubtedly stereotyped the curer's art, and consequently prevented change. I have less desire to dwell on this fact, because improvement in curing seems to make as slow advance in England as it does in Scotland; and the Government brand which exists in Scotland, has certainly no influence in England.

Take, however, the case of sprats. These fish are, perhaps, the cheapest food which the poor ever buy in England. But they are caught in such vast quantities that the supply constantly exceeds the demand. The tons, which cannot be sold as food, are used as manure. Now two obvious observations are applicable to this state of things. In Norway and Sweden sprats are pickled, salted, preserved in oil, preserved in tins, spiced, and, in all these various shapes, sold as Norwegian and Swedish anchovies. Curer after curer from these countries carried off medals at the Exhibition, for sprats preserved in these various ways. Can any reason be given why the tons of sprats, which are annually used in this country as manure, should not be dealt with in the same way? Perhaps, it may be answered, that it actually pays better to sell the fish as manure than to expend labour on it by preserving it as food. In that case, there can be no doubt among any persons acquainted with the principles of political economy—though there probably will be a good deal of doubt felt by other persons—that the fish had better be used as manure. But, even in that case, the contrast between America and this country is painfully unfavourable to ourselves. The Americans use menhaden just as we use sprats for manure. But the Americans, before they put the menhaden on the land, have the wisdom to extract the oil, which they sell for a large sum, and to make the residue into so-called guano. Perhaps all persons may not appreciate the advantages of this course. I will quote, therefore, a most instructive paragraph from the admirable Report by the jury on "Fish Oil and Fish Manure." "When fish guano," they write, "was first introduced into agriculture for manuring purposes, farmers complained of its not being sufficiently quick in its action upon growing crops to render it a desirable manure in comparison with Peruvian guano, sulphate of ammonia, nitrate of soda, and mixtures of these fertilisers with bone-meal or dissolved bones. *This defect* was partly due to the coarse mechanical condition in which fish guano was offered in the manure market, but *chiefly to the fact that formerly much more oil was left in the residue than at the present time. Oil, it may be remarked, has no value whatever as a manure,* and as it retards the decomposition of animal organic matter, the practical value of fish-guano, to some extent at least, is depreciated by the amount of oil which is left in the guano."

The sprats, then, used as manure in England are positively less valuable as manure, because the oil is not extracted from them. The Americans consider the oil which they extract from the menhaden as worth $733,000, the guano as worth $68,000. It may fairly be assumed that the same proportions are true in the case of sprats, and yet the British farmer, who places sprats worth £11 on his land, has never yet had the sagacity to discover that for every £1 worth of manure which he thus applied, he was positively throwing away oil worth £10, with the certain effect that the presence of the oil would retard the action of the manure. In truth, British farmers and British fishermen have something to learn from International Fisheries Exhibitions.

Something like the same waste is observable in Scotland. In America and in Norway, the refuse of fish which the curer rejects is made into guano. In the United States, the use of the refuse has largely increased the profit of the curer. "Mr. Earll has demonstrated that the secondary products in the cod fisheries amount to more than 14½ per cent. of the value of the fish as taken from the water, raising the receipts of several important ports by about $100,000 each" In Britain such minor matters as the use of refuse seem to escape attention. But the race for wealth is so keen, the struggle is so bitter, that it is high time to look after even little profits. Take the case of the herring fishery alone. If 1,000,000,000, herrings are annually cured, and the refuse of each herring only weighs one ounce, 1,000,000,000 ounces, 62,500,000 lbs., or nearly 3000 tons of refuse are annually thrown away. Can we afford to go on wasting such a source of wealth, which, if it were used, would add to the profits of the fishermen and the industries of the nation?

On this point it may be desirable to add that a great public company might usefully set a great public example. The Fishmongers' Company enjoys the singular privilege of examining the fish brought to London for sale, and of destroying so much of it as is unfit for food. It is a matter of common knowledge that the wardens of the company find serious and increasing difficulty in disposing of the fish which it is their duty to condemn. The Exhibition ought to have solved the difficulty. The condemned fish ought undoubtedly to be treated as the Americans treat the menhaden. It ought to be boiled; the oil extracted from the tissue, and the residue made into guano. It is probable, indeed, that such an operation, applied to only limited quantities of fish, would not pay; but, if a proper site were chosen for the factory, it is not impossible that the business would rapidly extend to develope; that fish would be brought to it which did not come to Billingsgate at all; and that some enterprising manufacturer would readily take over the concern. In the meanwhile, indeed, there is no reason to suppose that the Fishmongers' Company would not willingly submit to some loss. Its wardens are now subjected to a considerable loss in disposing of the fish, and they have always shown a praiseworthy readiness to do anything calculated to promote the development of the fisheries of the country. It is difficult to see how they could do better than prove the possibility of conducting in this country an industry which already flourishes on the other side of the Atlantic.

I have now exhausted one portion of the subject with which this Report is intended to deal; and I have endeavoured to determine whether the Exhibition has supplied British fishermen with any practical hints for the development of the fishery. I now propose to turn to a wholly different question, and to consider whether there is anything in the Exhibition to indicate that the supply of fish in any portions of the world is likely to be exhausted.

(7). POSSIBLE EXHAUSTION OF FISHERIES.

(a). *Sea Fish.*

In answering this question, it will be convenient, in the first instance, to deal with sea fish alone. And it may at once be stated that in certain places complaints are made of the exhaustion of the fishery. The writer of the preface to the Spanish collection complains of the "Bou," which he thinks injurious to the fishery. In Italy complaints are made of the injury arising from the capture of young sardines. In the colony of New South Wales similar complaints are made. In Hawaii it is supposed that the whale fishery has been injured by over fishing, and the United States has thought it necessary to determine the precise number of seals which shall be annually killed on the Islands of St. George and St. Paul. I have considered these matters in previous portions of this Report. But I am anxious to point out that, so far as sea fish are concerned, all the great countries of the world are practically proceeding on the hypothesis that the fisheries are inexhaustible. Britain, the United States, Russia, France, Canada, Norway, the Netherlands, Newfoundland — these and almost every other country are annually endeavouring to catch more fish, and none of them—or none of them, with one exception—are taking any steps to show that they believe sea fisheries to be capable of exhaustion. If we turn from the conduct of practical men to the opinions of skilled authorities, the same conclusions will be discovered. Professor Huxley sounded the keynote on the subject in the address which he delivered at the opening conference. "I believe that it may be affirmed with confidence," he said, "that the most important sea fisheries, such as the cod fishery, the herring fishery, and the mackerel fishery, are inexhaustible. And I base this conviction on the grounds, first, that the multitude of these fishes is so inconceivably great that the number or catch is relatively insignificant; and, secondly, that the magnitude of the destructive agencies at work upon them is so prodigious that the destruction effected by the fishermen cannot sensibly affect the death-rate." Professor Huxley's conclusions were not, of course, unanimously adopted; but I think that it will be admitted by any one who has studied the reports of the Conferences, that the vast majority of the most competent authorities ranged themselves on the same side of the controversy. The most serious doubt which has been thrown on this conclusion has arisen from the conduct of the United States Commission in breeding cod, mackerel, and other sea fish artificially. If the supply of fish is inexhaustible, it is not quite clear why a public body should spend time and labour in endeavouring to increase their numbers. Ordinary people, indeed, imagine that the fecundity of fish is so great that the vast majority of the fry must necessarily perish, almost at the beginning of their existence, from a want of adequate food. To increase the number of the infants is, therefore, only to increase the infant mortality. But, though the action of the United States Commission is apparently based on an opposite theory, the opinion of its leading member tallies with the conclusion of Professor Huxley. "Migratory, semi-migratory, or wandering fishes," writes Mr. Brown Goode ('Fisheries of the United States,' p. 64), "ranging in shoals or singly over broad stretches of ocean, mackerel, herring, menhaden, blue fish, bonito, or squeteague, are apparently beyond the influence of human agency, especially since they appear at a distance from the coast, or since the adults, when about to spawn, cannot be reached by any kind of fishing apparatus. Their fecundity is beyond comprehension, and in many instances their eggs float free near the surface, and are quickly disseminated over broad areas. The conclusions gained by Professor Baird tally exactly with those of Professor Huxley, that the number of any one kind of oceanic fish killed by man is perfectly insignificant when compared with the destruction effected by their natural enemies."

But, though the sea fisheries are inexhaustible, failure, for which it may not be easy to account or possible to explain, may occur in particular years or during long series of years. Examples of failures of this character have already been given in relating the history of the Norwegian herring fishery. Other instances of fish either deserting or returning to particular coasts might be cited. As Mr. Brown Goode says, "Their movements are no more to be anticipated than those of the atmosphere; and, in many instances, with no intelligible cause, some of the most abundant species, the blue fish, the chub mackerel, the little tunny, the scuppang, and the bonito, have absented themselves for considerable periods of years."

It seems, then, reasonable to conclude that oceanic fish, or fish which do not come habitually or necessarily into narrow estuaries or rivers, are incapable of exhaustion by any methods which man has yet invented, or seems likely to invent, for their capture. It appears, moreover, that temporary failures of particular fisheries must not be accepted as indications of exhaustion. These facts and conclusions have been familiar enough to professed ichthyologists for years past. But they have, on the whole, received strong confirmation from the testimony which the Exhibition has been the means of eliciting.

But it must not be supposed that these conclusions apply to all fish, or to all aquatic animals. "There are fisheries and fisheries," to quote Professor Huxley again. "I have no doubt whatever that some fisheries may be exhausted. Take the case of a salmon river, for example. It needs no argument to convince any one who is familiar with the facts of the case, that it is possible to net the main stream in such a manner as to catch every salmon that tries to go up, and every smolt that tries to go down." Mr. Brown Goode enlarges on a similar topic in a passage which is long, but which is carefully thought out, and is well worth quoting.

"1. Aquatic mammals," he writes, "like seals, may be entirely exterminated, especially when like the fur seals, they forsake the water and occupy the land for breeding purposes. The fur seals of our Pacific coast are nearly gone, except upon the Prybilor Islands of Alaska, where they are protected by the General Government, the Islands being leased to a company, who are allowed to kill only 100,000 each year, these being non-breeding males, and the permanence of this fishery being thus perfectly secured.

"2. Aquatic mammals which do not leave the water, such as whales and manatees, conspicuous on account of their size, and not capable of rapid multiplication, may be practically exterminated when they breed near the shore. As examples, may be cited the cases of the Arctic seacow of the North Pacific, *Rhytina stelleri*, and the Pacific gray whale, or devil fish, *Rhachinectes glaucus*, the tale of whose destruction in the lagoons of California may be found in Scammon's 'Marine Mammals of the Pacific Coast.'

"3. In the case of fixed animals like the sponge, the mussel, the clam, and the oyster, the colonies or beds may be practically exterminated, exactly as a forest may be cut down. The destruction of the oyster beds of Pocomoke Sound in Maryland, a large estuary, formerly very productive, is an example, the destruction being due more directly to the choking of the beds by the rubbish raked over them by the dredges, and the destruction of the ledges suitable for the reception of the young spat, than to the removal of the adult oysters, which was, of course, never effected.

"4. Fishes in ponds, lakes, or streams are quickly exterminated unless the young fish are protected, the spawning season is undisturbed, and wholesale methods of capture are prohibited.

"5. A river may be quickly emptied of its anadromous fishes, salmon, shad, and alewives, by over fishing in the spawning season, as well as by dams which cut off the fish from their spawning grounds. Examples of this may be found in dozens of American rivers. In the same way, sea-fish approaching the coasts to spawn upon the shoals or in the bays may be embarrassed, and the number of each shoal decimated, particularly if, as in the case of the herring, the eggs are adhesive and heavy. Sea fishes spawning in the estuaries are affected by wholesale capture with stake-nets, much in the same manner, though in a less degree, than salmon in the rivers. An example is apparently found in the temporary depression in the scuppaug or porgy fishery of Narragansett Bay."

Thus far Mr. Brown Goode. I should be tempted to add to his exhaustive statement that some of the larger crustaceans frequenting limited areas of rocky and sheltered foreshore may be temporarily exterminated by over fishing.

But, with this single exception, I believe that the experience of ichthyologists, the practice of fishermen, and the lessons fairly to be learned from the Exhibition itself all point to the conclusion that the fisheries, which are not included under one of Mr. Brown Goode's five heads, are practically inexhaustible.

If, however, this inference be correct, it naturally simplifies the duties of the statesman, the ichthyologist, and the fisherman. An inexhaustible supply cannot require the interference of the legislature, it need not occupy the care of the ichthyologist, or require abstention from the fisherman. Man may draw at will on a balance on which he can make no impression, and be perfectly satisfied that the fish, which he destroys, if he abstained from fishing, would be destroyed in some other way. There is, in fact, a balance of life in the ocean, as there is a balance of life on the land. Every animal, both in the sea and on land, reproduces its kind in greater numbers than can possibly exist. In other words, all animals tend to multiply more rapidly than their food; many of them must in consequence either die or be destroyed; and where, as in the case of fish, one female produces her tens of thousands, her hundreds of thousands or even her millions of eggs, the natural mortality is so great that the destruction, which man effects, is hardly worth considering. Man may enable the earth to support more of his own species by making the land more fertile; he may, in the same way, enable the earth to support more of other animals. It is certain that he may make ponds, it is possible that he may make limited areas of foreshore, more productive of fish life by similar expedients. But he cannot increase the capacity of the world to support either man or animals beyond a fixed point. When that point is attained, excessive mortality or destruction must supervene; and man may rest satisfied that, so far as the open ocean is concerned, the fish which he destroys if he abstained from destroying them, would perish in other ways.

(b). *Seals and Whales.*

There are exceptions to the rule, however, which Professor Brown Goode has pointed out; and on these exceptions I desire to offer some observations. In the first place, I am neither qualified to speak positively, nor in this country is it very necessary that I should speak about the possible extermination of seals and whales. With respect to the former, I have already pointed out that the restriction which the United States Government has placed on the destruction of seals in the Alaska Islands seems unnecessarily large. But, while accepting Mr. Brown Goode's conclusion that protection is necessary in certain cases, I may point out that many seals pup not on land but on floating ice. They are not, therefore, either found or approached with the ease with which those which pup on land may be visited year after year; and nature therefore has imposed in this way a limit to their destruction. With respect to whales, it seems to me clear from the facts obtained at the Exhibition that the extension of the petroleum trade is reducing the demand for whale oil; is consequently diminishing the profits of whaling; and is, thereby, affording indirectly a certain amount of immunity to the whales. Whales are being taken in decreasing numbers, not because there are fewer whales, but because their capture is less profitable.

I turn now, however, to the more important questions relating to the possible extermination of (1) molluscs and other "fixed" animals; (2) pond fish; (3) migratory fish, to which I have ventured to add; (4) the larger crustacea frequenting limited areas of rocky and sheltered foreshore.

(c). *Crustaceans.*

There is authority for thinking that, at any rate, in small areas of this character the supply of lobsters and crabs is falling off. The Commission on which I served, and which enquired into the condition of the crab and lobster fisheries of the British Islands in 1877, arrived at this conclusion. "We believe we are right in concluding," wrote the Commissioners, "that in small fisheries, or in fisheries in confined areas, there has been in every case a marked decrease of fish, while in large and exposed fisheries there has been no decrease whatever." It may be useful to compare this conclusion with the experience obtained in other countries. The three great lobster producing countries in the world are Norway, the United States and Canada. In all of them there is no experience of a decreased supply, but there is a curious expectation of a decrease. This is what Herr Wallem, the Norwegian Commissioner, says on the subject. "Our lobster fishery is still good; we have close time and a minimum size for marketable lobster. At an average we catch 11,000,000 of lobsters, and pay the fishermen a little over £19,000 a year for them. We are, however, on a look out for a decreasing fishery." ('Fish Supply of Norway,' p. 19.) The Canadian lobster fishery yielded in 1882 17,500,000 cans; and this is what M. Joncas has to say about it. "These figures not only indicate the extent of the interests connected with this branch of industry, but also suggest the danger of over production, both of which facts point to the necessity for economising and perpetuating the natural supply. There is nothing easier than to exhaust a shell-fishery, but also nothing harder than to revive it: and the Government of the Dominion, alive to the fact, is taking measures to prevent any indiscriminate fishing of the lobster on our coast. Doubtless, if the fishing that is now carried on was not subjected to strict regulations, all persons interested in it would prosper for a short time, and the country would appear to benefit by the rapid and extensive development of this resource. But a period of reaction would necessarily ensue. Consequently, if we wish to perpetuate such a valuable possession, it is wiser to economise it in time than to be obliged later on to make extreme and costly endeavours to arrest its decline, or to restore it from complete exhaustion" ('Fisheries of Canada,' p. 28). Mr. Brown Goode indicates that lobsters in the United States are disappearing from grounds which they used to frequent. He quotes on the subject M. Rathbun as follows: 'The lobster fishery began on the Massachusetts coast about the beginning of the present century, and on the Maine coast about 1840. It has rapidly developed to the present time. At first lobsters were frequently found near low water mark. They rarely occur in such situations now, and the fishery is mainly carried on in depths of a few fathoms to 20 or 30 fathoms, but sometimes in depths of 40 to 60 fathoms" ('Fisheries of United States,' p. 48).

American experience seems then to indicate that the lobsters are being gradually fished out in shallow water; the experience of a British Commission points to the somewhat similar conclusion that lobsters are easily over-fished in small and confined areas; and, while there is no decrease in Norway or Canada in the produce of the lobster fishery, a singular apprehension exists in both countries that if the present rate of capture is continued the fishery will be over-fished. Such apprehensions need not, in my judgment, disturb us much even when they emanate from such excellent authorities as M. Joncas and Herr Wallem. The presumption I believe with most marine animals is that the supply is inexhaustible by man; and, until the contrary is proved, the presumption ought to be accepted. But the failure in the supply of lobsters in certain parts of the British Islands and in some conditions in the United States, naturally induces inquiry and reflection. Mr. Saville Kent, a naturalist of repute, in his paper on 'The Artificial Culture of Lobsters,' partly attributes the decay of the fishery, which he assumes to be general, to the "pernicious practice of utilising the spawn or berry of the lobsters for culinary purposes" (p. 15). He suggests the artificial culture of the fish as the best means of restoring it to abundance. But it does not seem to have occurred to Mr. Saville Kent or the many gentlemen who object to the killing of spawning lobsters, that the hen lobster is just as valuable or almost as valuable when she has the spawn inside her body as when she carries it outside of her. Yet no one suggests that it should be made illegal to kill hen lobsters but only that it should be made illegal to kill hen lobsters with the spawn outside of them. Such a regulation would be similar to a law which made it legal to kill a cow during the first four and a half months, and illegal to kill a cow during the last four months and a half of gestation. But, though the regulations would be similar in principle, they would not be similar in expediency. For the cow during the last half of the period of gestation would make very bad beef, and consequently command only a low price in the markets, while the berried hen lobster has a value of its own, and in fact commands a higher price than any other lobster of the same size.

Without, then, entering into other and practical difficulties, which are almost if not quite insuperable, and which are set out at length in the Report of the Commission on crabs and lobsters, there does not seem any more justification for prohibiting the capture of berried lobsters than for prohibiting the capture of "full" herrings, or of herrings about to spawn. But the circumstance does not, of course, prove that it may not be wise to adopt Mr. Saville Kent's recommendation and to breed lobsters in large numbers artificially. The chief objection to this course is the apparent difficulty of doing so. Mr. Saville Kent, indeed, states that he succeeded in 1875 in breeding young lobsters artificially in the Manchester Aquarium, and that "considerable numbers" of them survived through the several stages which young lobsters pass as zoea. The success of this experiment is very creditable to Mr. Saville Kent's energy and care. But it does not at all follow that because it is possible to do a thing on a small scale in an aquarium it is therefore possible to do the same thing on a large scale so as to make it a commercial success. The experience of practical men is certainly opposed to Mr. Saville Kent's recommendation. "We have tried to hatch and cultivate the lobster," such is Herr Wallem's testimony, "but have not succeeded, having not been able to keep the hatched young ones alive more than a few days; then all of them disappear, leaving no trace to tell how or why they disappeared" (Fisheries of Norway, p. 19).

It may be thought that Mr. Saville Kent's experience on a small scale in Manchester may negative Herr Wallem's conclusions. To a certain extent it probably does. But I imagine that Mr. Saville Kent can have no idea of the prodigious extent to which it would be necessary to breed lobsters artificially in order to make any effect on the stock of lobsters in the sea. A statement was made by Mr. Brown Goode in the discussion on Dr. Day's paper on 'The Food of Fishes' which illustrates this point, and shows in a remarkable manner the extraordinary character of the operations of nature, and the small extent to which man's artificial help can aid them. "About twenty years ago," said Mr. Brown Goode, "mackerel were very plentiful in Massachusetts Bay, but suddenly there appeared great shoals of blue fish, fish of say 16 to 20 lbs., exceedingly predaceous, which destroyed all other fish in great numbers. That fish, which had been absent from the coast for many years, made its appearance suddenly round Cape Cod, and before this the mackerel vanished, and the mackerel fishery decreased exceedingly; but at the same time there was a corresponding increase in the lobster fishery. No one knew what to make of it until a very acute old fisherman, Captain Attwood, went to work and studied the subject, and he demonstrated pretty plainly that the absence of the mackerel had had the effect of increasing the number of lobsters, because the mackerel were in the habit of feeding on lobster eggs." Mr. Brown Goode, I may say in a parenthesis, probably means the larvæ of the lobster, not lobster eggs. I commend the story to Mr. Saville Kent. This gentleman publishes a calculation of the late Mr. Buckland's to show that the London cooks actually use as garnish for turbot 1,750,000 lobster eggs a year. Big figures of this kind excite dismay, and seem to prove the necessity of prohibiting at all cost the capture of berried lobsters. But supposing the cooks use 1,750,000 larvæ, what about the mackerel? If each mackerel only eats ten larvæ a year, 175,000 mackerel must eat 1,750,000 eggs. So far then as the lobsters are concerned, it would be just as advantageous to kill an additional 175,000 mackerel, as to prohibit cooks using lobster berries for the dressing of turbot. I am inclined, therefore, to think that instead of prohibiting the fishermen from catching berried lobsters, and thereby reducing their profits, Mr. Saville Kent will do well to encourage them to catch a few more mackerel, and thus increase the food at the disposal of the community.

(d). *Oysters.*

I now pass to a more difficult subject, the possible extermination of "fixed" animals, as Mr. Brown Goode calls them, and especially of sponges, mussels and oysters. With respect to sponges, no experience which I was able to obtain in London pointed to the approaching exhaustion of the fishery. On the contrary, all the nations engaged in the sponge fishery are apparently acting as if the supply was inexhaustible. It seems, however, obvious that an animal like the sponge, which may be gathered from the bottom of the sea by divers, might be almost as effectually eradicated as—to quote Mr. Brown Goode's simile—a forest might be cut down. There may not be sufficient divers to catch all the sponges in any given place; just as there may not be sufficient woodsmen to fell the forest. But, in both cases, the accomplishment of the process only depends on the supply of labour. It is sufficient, however, for present purposes to say that the supply of sponges apparently keeps up with the demand; and that, whatever may be necessary hereafter, no apparent need exists for regulating the fishery.

A different conclusion must, I fear, be expressed respecting oysters. No one can doubt that the supply of oysters, at any rate in this country, is not keeping up with the demand. It is within every one's experience that the same number of native oysters which used to be procurable for 1*s.* are now worth 2*s.* 6*d.*; and, in nine cases out of ten, the oysters which are sold in London as natives are not natives, but French oysters fattened at Whitstable. It is not, indeed, clear that the increased price is not partly due to an increased demand; but there can be no doubt of the gradual exhaustion of this particular fishery. It is not surprising that the experience which we have ourselves undergone, should alarm the authorities of other nations, and that the United States in particular, whose oyster-fisheries employ an average of 56,000 persons, and yield a produce of millions of pounds sterling, should conclude that "a speedy extermination of this most valuable mollusc will doubtless result unless some effective means of protection and artificial culture are soon employed" ('Fisheries of United States,' p. 30).

It may be remarked that the direct cause of exhaustion in the United States seems to differ from the direct cause of exhaustion in this country. Here it is almost universally admitted that an oyster-bed cannot be too much worked. Many people, indeed, think that too many oysters can be taken from the bed, but all authorities are agreed that the bed cannot be too frequently dredged over. The dredging destroys the weed, cleans the cultch, and removes the vermin which prey on the oyster. But in the United States a different view is apparently held. In a passage which I have already quoted, Mr. Brown Goode ascribes the destruction of the oyster-beds of the Pocomoke Sound "to the choking of the beds by the rubbish raked over them by the dredges." It is singular how absolutely opposed Mr. Brown Goode's experience in America is to the experience of practical men in Europe; and the circumstance shows plainly how impossible it is to lay down any dogmatic rules applicable to all climates and all peoples.

In America, as in Europe, the best authorities think that the only means of saving the fisheries will be to terminate the public right of fishing, and to grant the grounds to private individuals. Property, it is presumed, will have the magic effect on the fisherman which it is supposed to exert on the landowner. It will stimulate his activity, his industry, and his ingenuity; and the fisherman, ensured of reaping the profits of his labour, will cultivate his oysters with success. "There is difficulty," indeed, according to Mr Brown Goode, "in carrying out the policy in the case of natural beds, to which the fishermen have had continued access for centuries. It is probable that the present unregulated methods will prevail until the dredging of the natural beds come (? cease) to be remunerative, and that the oyster industry will then be transferred from the improvident fishermen to the care-taking oyster-culturists, with a corresponding increase in price and a decrease in consumption" (p. 63).

I quote the passage, because the prophecy which Mr. Goode makes is really only a statement of what has occurred in many places in this country. The natural beds have, in many cases, ceased to be remunerative, the public right of fishing upon them has consequently been terminated, and the beds have been appropriated to private individuals or companies. Unhappily, the facts still further correspond with Mr. Brown Goode's prediction. The price of the oyster has increased and the consumption has decreased. Such a consequence suggests a doubt as to the wisdom of the policy. It may possibly be desirable and justifiable to terminate a public right for the sake of securing a great public advantage. But there seems to be no adequate reason for terminating a public right if the advantage be not secured. The public right of fishing, it must be recollected, is to the fisherman what the common is to the peasant. It would be a serious misfortune if the fisherman were exposed to the same class of evils as the enclosure of commons has inflicted on the agricultural labourer. The enclosure of commons used to be commonly justified by the argument that lands would be broken up, that more labour would be employed in tilling them, and that more wheat would be grown. The appropriation of public oyster-grounds has been similarly justified by the theory that more pains would be taken in cultivating them, that more labour would consequently be employed, and that more oysters would be produced as food. But, in too many instances, the land which was broken up when it was first enclosed, has been thrown back into grass, and affords no additional employment to the labourers from whom it was taken, and yields no additional food to the public: and, in precisely the same way, it has been found that the private oyster beds have not proved remunerative, the men working them have been discharged, and that no addition has been made to the stock of oysters.

If this be a fair statement of the condition of many beds on which the public enjoyed originally a right of fishing, but which are now in private hands, it is a matter of serious importance to ascertain whether the fault lies in the system which has been pursued, or whether there has been merely some mismanagement in carrying out the system. Many oyster-culturists must have looked forward to the Exhibition to enable them to solve this question. But, unluckily, the Exhibition has given them very little aid towards its solution. It is understood that France, as a whole, has been more successful in oyster culture than any other nation. But France has unluckily taken so little a part in the Exhibition that it is impossible to follow out minutely the details of what she has been doing. The most important contribution which the Exhibition has made to the science of oyster culture is the account—to which I have already alluded—which M. Hubrecht has given of the successful experiment in the Scheldt. The most sensational circumstance connected with oyster culture that the Exhibition has revealed is the remarkable failure of the Greek oyster fishery. During the last two years according to M. Apostolides ('Pécheries de la Grèce,' p. 82), the Greek fisheries, which had previously been famous for the abundance of oysters, had none of these molluscs upon them. The shells remain, but the fish are gone, "détruites certainement par putréfaction." Some people imagine, M. Apostolides adds, that the employment of dynamite in fishing has led to this destruction. But M. Apostolides rejects this theory, because the oysters are found dead in places where dynamite has been never used. I shall not presume to offer a solution for a problem which M. Apostolides professes himself unable to solve. I simply allude to it as a proof that other causes, besides over fishing, may interfere with the production of oysters.

There is, however, every reason for supposing that oyster culture has of late years succeeded in countries like France and Holland, while it is certain that it has failed in England; and it is of the highest interest to endeavour to ascertain the causes which have produced different results with the Dutch or French and ourselves. I have already pointed out that, in the case of the Scheldt, a limited area has been practically reserved on which the oysters are never touched; and which, there is reason to believe, has been the means of supplying the neighbouring ground with a plentiful supply of spat. But there is another circumstance connected with the experiment on the Scheldt which also deserves consideration. In this country it has been the practice, when public grounds are appropriated to private individuals, to confer the whole tract thus appropriated on one company or one individual. In one case, which acquired some notoriety, more than nine square miles of sea-bottom and foreshore were appropriated to one company. But in Holland, as M. Hubrecht shows—and I may add in France—the appropriated foreshore or sea-bottom has been allotted to a variety of individuals. In the Scheldt, for instance, the allotments range from 12 to 150 acres. I need hardly point out that the multiplication of allotments affords chances of success which are almost entirely absent where all the shore is concentrated in the hands of a single owner. Oyster culture is an experiment; and, if the 640 acres which every square mile comprises are given to one man; one experiment only is instituted for the square mile. But if the 640 acres are divided among 50 men in patches of from 12 to 14 acres, the State institutes on the same space 50 distinct experiments. Success on any one of the 50 allotments would probably lead to the peopling of the whole square mile with oysters, as the spat are carried over a large area by the action of the tide. The chances of success, therefore, under such a system are as 50 compared with the one single chance of success under the system which has been pursued in this country.

I do not propose to pay much attention to the possible exhaustion of pond fish. The cultivation of pond fish is never likely to be carried on to any very great extent in the British Islands; and Germany, the country in which it is conducted with most success, sent nothing to the Exhibition to illustrate the system which she pursues. I pass on, therefore, to the fifth of the cases in which it is stated by Mr. Brown Goode that a fishery may be exhausted; and the particular case is of such importance that I shall preface my observations by re-quoting his precise words.

(e). *Sea Fish Spawning near the Shore.*

"A river," says Mr. Brown Goode, "may be quickly emptied of its anadromous fish by over-fishing in the spawning season, as well as by dams, which cut off the fish from the spawning grounds. . . . In the same way, sea-fishes approaching the coasts to spawn upon the shoals or in the bays may be embarrassed, and the numbers of each shoal decimated, particularly if, as in the case of herrings, the eggs are adhesive and heavy. Sea-fishes spawning in the estuaries are affected by wholesale capture with stake-nets, much in the same manner, though in a less degree than salmon in the river."

It will be seen that the paragraph contains three distinct allegations—(1) That anadromous fish may be exterminated (*a*) by over fishing in rivers; (*b*) by dams; to which Mr. Brown Goode should probably have added (*c*) by pollutions. (2) That the shoals of sea-fish spawning near the coasts may be decimated. (3) That sea-fish spawning in estuaries and bays may be "affected" by stake-nets. I will take the three points in the reverse order to that in which they are stated by Mr. Brown Goode.

1. There can be no reasonable doubt that sea-fish spawning in estuaries and bays may be "affected" by stake-nets. But it is hardly worth discussing so mild a proposition. The sole question, worth considering by practical ichthyologists, is whether they are affected to such an extent as to reduce their numbers. Stated in this limited way, the question is not so easily answered as might be supposed. "Stow-nets, and some kinds of weirs, such, for example, as those used in the neighbourhood of Swansea, take vast quantities of small and unsizeable fish along with those that are saleable." So wrote the Royal Commission of 1863. "There is no doubt that a very large destruction of sea-fish fry takes place in the estuaries and on the coasts of Cornwall and Devonshire by the use of small-meshed seines. . . . The destruction of the fry of sea-fish by fixed engines is even greater. The hose-nets in Bridgewater Bay, for instance, take at every tide basket-

fuls of immature fish, which are practically useless, and which are frequently left dead on the mud." So wrote the Commissioners of 1878. There can be no doubt, therefore, that the views of competent persons in this country support Mr. Brown Goode's allegation that sea-fish may be "affected" by fixed engines. But it does not follow that the fisheries are injuriously affected by them. This is what the Royal Commission of 1863 had to say on the point. "Nothing can seem more consonant to reason, or more necessary *à priori*, than that the supply of any kind of fish should be permanently diminished by this great and constant destruction of the breeding fish or of the young fry; and yet nothing is more certain than that this apparent necessity does not exist." And the Commissioners of 1878 place the same conclusion in even stronger language. "All sea-fish," they write, "during the earlier stages of their development draw in either to estuaries or to the shallow waters which fringed the shore. But, speaking generally, there is no reason to suppose that the operations of man are making any sensible impression on the number of the fry even in these places, since there is no evidence that the stock of fish in the sea generally is decreasing."

Though, therefore, it must be admitted with Mr. Goode that sea-fish spawning in estuaries or bays are affected by stake-nets, just as, he might have added, they are affected by other modes of fishing, there is no evidence to show that the stock of fish in the sea is in consequence decreasing. The experience of this country points to an opposite conclusion; and the experience of no country, apparently, so far as it can be gathered from the Exhibition, points to the decrease of sea-fish off its coasts.

2. I come now to the second of the allegations made by Mr. Goode, "That the shoals of sea-fish spawning near the

coasts may be decimated." I doubt whether any practical fisherman in this country would support this conclusion. I doubt, for instance, whether the fishermen who fish the famous herring-spawning bank off Ballantrae, on the coast of Ayrshire, could with all their exertions catch one fish out of every ten spawning on that bank. Most practical persons, who have inquired into the subject, would perhaps doubt whether the fishermen succeed in taking one fish in each hundred; while, according to the Herring Fishery Commission, "it is certain that the gannets at Ailsa Craig, and the cod on the adjacent bank, kill far more spawning herrings at Ballantrae than all the Ballantrae fishermen." I do not think, therefore, that practical men in this country will agree with Mr. Brown Goode that it is possible to "decimate" a shoal of fish spawning near the shore. But, even assuming it were possible to do so, I doubt whether any harm would, in consequence, result. No one would think a farmer improvident who brought one-tenth of his herd annually to market. A fish reaches maturity much more rapidly than an ox, and is some thousands of times more productive than a cow. Why then should it be improvident for a fisherman to do what no one would think a farmer improvident for doing? In short, though I doubt the possibility of decimating a shoal of fish, I should regard such a course, if it were practicable, as about the best use the fishermen could make of it.

(f.) *Salmon.*

3. I come now to Mr. Brown Goode's remaining position, that a river may be quickly emptied of its anadromous fish by over fishing in the spawning season, as well as by dams which cut off the fish from the spawning grounds; and

I should like, in the first instance, to restate this proposition in another way. A river may be quickly emptied of anadromous fish (*a*) by dams which cut off fish from the spawning grounds, and (*b*) by pollutions which make the water unfit for the fish to live in. The stock of anadromous fish frequenting a river may be injuriously reduced by over fishing either in the spawning season or at any other time. I will endeavour to make good these three positions, and to consider the means which the Exhibition has suggested for remedying these three evils.

The first position does not require many words to establish. Ichthyologists are agreed that the spawn of salmon can only be hatched out in fresh running water. The erection of a dam, therefore, which excludes the salmon from fresh running water must "empty" the river of the fish. Experience has proved that this result has ensued over and over again; and probably the erection of dams for milling, navigation, and other purposes was the chief cause which originally led to the exclusion of salmon from many rivers. It is, of course, true that the dam operates very differently at different seasons. Every flood in the river, as a general rule, mitigates the injurious effect of the dam. But it is also true that there are some dams which are either so high, or which are constructed in so peculiar a way, as to be impassable by fish in any floods; and these dams consequently, in Mr. Goode's words, quickly empty the river of anadromous fish.

SALMON LADDERS.

These facts have been recognised by fish culturists for many years; and, in consequence, they have set themselves to devise expedients for minimising the evils which the erection of dams occasions. These evils can probably never be remedied completely. A dam not only excludes the fish from the spawning ground, but it also alters the character of the stream in which it is built. It turns the sharp current, which the salmon likes, into a deep slow canal. The navigation dam is erected, of course, with this express object. The erection of dams, therefore, by altering the nature of the river, will always tend to alter its fish fauna. The fish, like a salmon, revelling in a sharp current will be injuriously affected; and the fish, like a pike, which prefer a still stream will be favourably affected.

Whatever expedients, then, may be adopted to reduce the evils which dams occasion, they will not restore the river to its original excellence for salmon. The evil can only be abated; it cannot entirely be removed. Abated it undoubtedly can be by the erection of fish-ways or fish-passes to enable the fish to pass the dam, which would otherwise be impracticable. The first fish-pass which was ever erected was, I believe, built in Scotland, at Deanston. A model of this pass, exhibited by Messrs. Stuart and Co. (Catalogue, p. 92), was at the Exhibition. Its construction undoubtedly proved that, by checking the course of water as it flowed down the smooth face of a dam by transverse stops, fish could be made to surmount a dam which they could not otherwise easily pass. But the ladder at Deanston was built at the same time as the dam. Thousands of pounds were spent on the erection of the dam and the ladder; and the expense which was incurred, admirable as the results proved, made it impossible to attempt a repetition of the experiment on the same scale at many places.

The success which had, however, undoubtedly been achieved led other persons to reflect on the principle which had determined it. It was seen that by confining the water passing over a certain portion of the face of the dam, and checking its progress by transverse stops one below the other, a water staircase had been formed. Every one knows that the staircases in ordinary houses are built of every variety of steepness. In the same way it seems to have been concluded that the water staircases which were to enable salmon to pass dams might be constructed at every variety of gradient. The proprietor of Deanston had led the way by building a staircase fit for a palace. But for practical purposes of life it was only necessary to have some stairs which would do for a cottage. The Deanston ladder had a gradient of 1 in 27, and a width which varied from 9 feet at the top to 40 feet at the bottom. But it was rashly concluded that ladders might be erected on the same principle, with a gradient of only 1 in 3, and with an average width of only 4 feet.

In consequence of this conclusion a small model was erected in the Fisheries Office in London showing the principle of the proposed ladder; and ladders on this pattern were sown almost broadcast—if such a metaphor may be used—on English rivers. The result, no doubt, produced both discouragement and disappointment. Many of the ladders proved failures, and the money spent on their construction was wasted.

In consequence of this failure, the Home Office reconsidered the policy which it had previously initiated. Instead of adopting a pattern ladder applicable to every dam, its advisers decided on dealing with each case as it arose, and considering what would be the easiest method of passing fish over the obstacle. Passes on every sort of system were accordingly constructed, and a considerable and gratifying success was in this way gradually secured. But even in salmon cultivation the human mind naturally vibrates from one extreme to the other extreme of thought; it had passed from a fixed pattern of salmon-pass to no pattern; it is apparently attempting now to resort to some new expedient which may be universally applicable, and inventors accordingly come forward with designs capable of use everywhere and of surmounting every difficulty.

The two chief designs exhibited in London with this object, to which it is necessary to allude, are the plan of Mr. Cail, an English engineer, and the plan of Mr. Macdonald, an American. Neither of these are indeed new. Mr. Cail's plan has been invented for some time, and experts have also been familiar with the Macdonald ladder for the last few years. The Jury, therefore, is mistaken in stating that the Macdonald fish-way, "illustrating a principle in supplying water to fish-ways, is quite novel." Briefly stated, the plan of Mr. Cail's pass is to admit only a definite quantity of water to it through a hole considerably below the surface of the water above the dam, and to allow the same, or rather a smaller quantity of water, to escape through a hole at the bottom of each transverse stop. There is no question that this pass has the great advantage that it enables salmon to pass up a river by the abstraction of the minimum of water from the mill or factory which the dam supplies. Whether this circumstance may not increase the difficulty which the fish may experience in finding the pass is a question which can perhaps only be determined by the experience of its actual working. Mr. Cail, I believe, alleges, and alleges with truth, that, in one case at any rate, his pass has proved successful, and the circumstance, so far as it goes, is undoubtedly a point in favour of his system.

The American inventor proceeds on a different principle. In the Macdonald fish-way "the water as it descends is checked and forced upwards again, and an even stream of broken water is kept up throughout the entire length of the pass, and fish are able to ascend it even if the gradient is as steep as one in three." So speak the Jury. I have no reason for doubting their conclusion, except the perhaps unsatisfactory one that similarly confident statements about the efficiency of other passes have been so frequently falsified by the result that I hesitate to accept any proof of the success of a fishway until I have seen it in practical operation. If, however, the Macdonald fish-way is really capable of passing up fish at a gradient of one in three, it is an invention of the highest moment to the cause of salmon culture. Perhaps few things could be more advantageous than to select two natural or artificial falls up which no salmon have ever passed, and build a Macdonald fish-way on the one, and a Cail salmon-pass on the other. That experiment would in a couple of years establish beyond the possibility of dispute the efficiency of each invention.

POLLUTION OF RIVERS.

I now proceed to consider the second cause by which salmon may be exterminated from a river, by the pollution of the water. It does not require many words to show that where water is made poisonous to life by means of pollution fish cannot live in it. The highest interest attached therefore to the exhibits intended to show how polluted water may be purified or made less impure. It is impossible, indeed, to avoid sharing the regret expressed by the Jury at "the absence of exhibits which had been promised from several foreign countries," and at "the paucity of exhibits in this group." The Jury added that, "while they can honestly say a word of praise regarding all the processes exhibited, there were none which appeared to them to possess extraordinary merit."

The objects to which the Jury assigned the highest awards were (1) the collective exhibits of the Manufacturers' and Millowners' Mutual Aid Association, and (2) the exhibit of the Native Guano Company. Under the former head five separate systems were shown: (1) Needham & Kite's high-pressure filter, constructed for detaining substances held in suspension and for clarifying fluids. It "has been in use at the paper mills of Joynson & Son, St. Mary Cray, Kent, and Alexander Perie & Sons, Aberdeen, Scotland, for upwards of twenty years in filtering the pulp-waters, which formerly fouled the stream; (2) Green's system of ore-dressing; (3) a model exhibited by Mr. Harris, applicable to metalliferous mines, by which the same water is used continuously over and over again in dressing the ore; (4) the Schaffner and Helbig process; and (5) the Peckiney process for the extraction of sulphur from alkali works. The Native Guano Company exhibited its well-known process for purifying sewage. "The effluent water," said the Jury, "is clear, bright, and scentless. Cattle drink it; fish live and thrive in it; and chemical analyses by Dr. Angus Smith, Dr. Tidy, and other eminent chemists, prove that it is within the requirements of the Rivers Pollution Prevention Act, and may therefore be admitted into any river."

It may be hoped, therefore, that some advance has been made (1) in counteracting the evils occasioned by the erection of weirs; (2) in remedying the injuries caused by river pollution. But I have still to consider the remaining proposition of Mr. Brown Goode, that a river may quickly be emptied of anadromous fish by over fishing in the spawning season. I have already stated that I should prefer to limit this proposition in one direction and to extend it in another. I doubt the possibility of emptying a river of anadromous fish by over fishing ; but I have no doubt that its fisheries may be seriously injured by over fishing. I admit that over fishing in the spawning season is specially injurious, but I think that over fishing at almost every period of the year may result in serious injury. The truth of the proposition stated in this way must be apparent. An anadromous fish spawning in the fresh waters of a river is an animal which is forced probably during every year of its mature life to pass once up and once down the river channel. If it were not that heavy floods occasionally interfere with man's best contrivances, and that the fish instinctively move upwards and downwards in floods, it would obviously be possible for man to stop every fish either in its passage up the river from the sea or down the river from the spawning-beds. Floods, and floods alone, make it practically impossible to effect this ; but, notwithstanding the advantages which floods do offer to the fish, there can be no doubt that man, when his fishing is unrestricted, can and does catch large and undue proportions of the migrating fish, and that the fisheries for anadromous fish are consequently seriously injured by his operations.

ARTIFICIAL FISH CULTURE.

A recognition of this fact has led in most countries where salmon exist to the passage of a series of laws for their preservation. These laws, which probably have attained their chief development in our own country, set apart a period of each year, during which no salmon shall be caught except by angling; and they simultaneously prohibit certain modes of fishing which are either proved to be, or supposed to be, unusually destructive. Such are the chief provisions of every code of salmon laws. They are undoubtedly framed with two objects; the first of these is the preservation of a certain proportion of fish for spawning purposes, and would probably be accomplished by a close season alone; but the second of them, which endeavours to distribute the fish with some approach to evenness among the various parts of the river, is effected, or attempted to be effected, by what is known as a weekly close season, which affords a certain number of fish an opportunity of passing up the river. The British legislature has steadily adhered to legislation of this character. In the United States, however, a new and wholly different principle has been adopted. Instead of attempting to restrict the killing of fish, the Americans determine to repair the waste by breeding fish artificially to be killed. They assume that, if fish are bred in sufficient numbers, they may be killed in numbers which seem incredible, without any injury being inflicted on the future condition of the river.

It seems impossible to doubt that, if the American system is right, the whole theory of salmon preservation in this country will require reconsideration. If the results which the Americans cite are really due to artificial culture, then artificial culture is a much more powerful agent for good than preservation. Again, if it be true that a hatching station, capable of producing fish by the million, may be maintained for about 500*l.* a year, it is a much cheaper thing to set up a hatchery than to employ a staff of water-bailiffs. If, then, it is the object of Parliament, in passing Salmon Acts, to increase the food of the people, and this is the object which Parliament has itself assigned for their passage, the cheapest and most effective mode of procedure will be—if the Americans are right—to repeal all restrictive legislation and to trust to artificial culture.

Such a result would undoubtedly entail one inconvenience. It would, in all probability, destroy salmon angling. The salmon would be taken without let or hindrance in the lower waters, and they would never be permitted to reach the angling waters. Most people will think such a loss a very serious one. A densely-populated country like our own is not so rich in outdoor pursuits that it can easily afford to part with one of its healthiest recreations. On the other hand, it must be recollected that, if restrictive legislation promotes angling, it also produces a certain amount of crime. If there were no laws, there would be no law-breakers. But I am not anxious to express any opinion on these points. I am only desirous to indicate their nature. If it be really true that salmon may be bred by the million and caught by the hundred thousand at a cost which is trifling; and if it be the case that the object of Parliament in devising salmon laws is to increase the number of salmon that are caught, the Salmon Acts should be repealed, the water-bailiffs dismissed, and an artificial hatchery erected on every salmon river.

I believe, indeed, that, with the exception of the United States, no country in the world accepts the view that artificial culture alone will stock a river. I had the advantage of a long conversation with Mr. Wilmot, the founder of artificial culture in Canada, and its vigorous supporter in that dominion. But Mr. Wilmot, much as he believes in artificial culture, holds strongly to the opinion that it must be supplemented by strict preservation. Mr. Wilmot, therefore, occupies a middle position between the United

States and this country. The United States believes in breeding fish and not preserving them; England believes in preserving fish and not in breeding them; Mr. Wilmot believes both in breeding and preserving them.

I have already examined in my account of the Pacific salmon fishery the remarkable figures of the United States Commission. But the subject is of such vast importance that I desire, before closing this Report, to offer some more general remarks on fish breeding. And, in the first place, the utility of artificial culture for the purpose of stocking a river, or even a country, with new kind of fish has been abundantly proved by the introduction of carp into America, and of trout and sea-trout into Tasmania. For such results as these mankind is indebted to the fish culturist. But the new claim of the fish culturist—which, if the American figures cannot be otherwise explained, is apparently established—is, that it is possible to breed fish artificially for commercial purposes. It is this claim, which the Americans assert as indisputable, that has startled people, trained in a different method, in this country.

It is not surprising that the extraordinary success, which American fish culturists claim to have obtained, should have drawn attention everywhere to the advantages of fish culture. Exhibitors from "England, the United States, Canada, Germany, Russia, Austro-Hungary, France, the Netherlands, Norway, Sweden, China, and Denmark" sent to London "models or drawings of fish hatching, breeding, and rearing establishments." It would be a matter of very little interest, and it would at the same time be a source of almost insuperable difficulty, to give a technical description of the various machinery used in the process; and I think I shall do better service by drawing attention to several principles, some of which may be regarded as settled, and others of which may be regarded as in dispute, which are involved in artificial culture.

In dealing with artificial culture, moreover, I shall confine my observations to the artificial culture of salmon. I am aware, of course, that the artificial culture of the white fish (*Corregoni*) plays even a larger part in America than the artificial culture of salmon. But the artificial culture of the white fish is never likely to attain any considerable importance in this country, and it will be better, therefore, to confine the present observations to the only artificial culture likely to be practised here—that of the salmon.

The first step which the salmon culturist has to take is to secure his spawning salmon. Those who are acquainted with the extreme difficulty which has been experienced in this country in obtaining a few thousand salmon eggs for transport to Australasia, will read, with something like envy, an account of the ease with which this indispensable preliminary work is accomplished in the United States. In reviewing the work accomplished in 1878 at the McCloud river station (the McCloud is a tributary of the Sacramento), the United States Commissioner wrote: "It will doubtless somewhat astonish many persons at the East (*i.e.*, in the Eastern States) who are not familiar with the scale of operations on which fish culture is conducted at the west, to be told that from seven to nine thousand salmon were several times taken at the station (*i.e.*, the station for breeding purposes) in a single day." An adverse critic would indeed be tempted to remark that, if this number of fish is passing up one of the tributaries of the Sacramento to spawn, it is not necessary to seek, either in artificial culture or in any other operation of man, an explanation of the surprising produce of the tributaries of the Sacramento. Nature herself must be producing salmon on a scale which makes the efforts of the United States Commission, gigantic as they are, seem absolutely insignificant.*

It is not, however, at every hatching station that spawning salmon can be obtained with the ease with which they are caught on the Sacramento. In other places it is found necessary to construct weirs, below which they can be caught, and ponds, in which they can be kept till their spawn is mature. These ponds have usually been placed in fresh water. The Canadians exhibited a "plaster-cast of a bird's-eye view of one of their fishing stations, where two or three hundred salmon, purchased from the fishermen, are placed annually in a salt water pond in May and June, kept till ready to spawn, and then returned to sea, this plan being found to answer better than that of catching the fish in the rivers at spawning time" (Jury's Report).

I will not enter into any technical description of the manner in which the fish are manipulated. I will simply say that all the best authorities in the States, in Canada, and in England place the eggs in a stream of fresh unfiltered water. But I will pass on to the treatment of the fish after they are born. I suppose that, in a report written for persons acquainted with fishing, it is unnecessary to state that every young salmon, when it is first born, is provided with an umbilical bag, containing the yolk or food during which it is sustained during the first six weeks of its existence. All authorities are agreed that during this period the young fish ought to be retained in the hatchery. Sir James Gibson Maitland, whose breeding establishment at Howietown, near Stirling, is, I believe, not only the most complete in the country, but the most complete of any private breeding establishment in the world, in a paper on the Culture of Salmon which he read at one of the conferences at the Exhibition, has apparently some inclination to keep the fish in the hatchery long after that stage. "The size of the river has no fixed relation," so he writes, "to the number and weight of the fish caught in its estuary and contiguous sea-board, and if a very large number of smolts were annually turned in immediately above the tidal waters, the stock of salmones would be increased by a proportion of the number turned in, fixed only by the conditions of food and of natural enemies in the estuary and adjoining sea. I do not say for an instant that all the fish reaching maturity would return, or attempt to return, to the mouth of the river in which they were liberated as smolts, but I think that the evidence tends to show that most of them would do so. The question at this point resolves itself into a matter of pounds, shillings, and pence. Salmon smolts of two years old can now be raised at less than sixpence a piece, and salmon in the estuary at their return are probably worth on an average five shillings each" (pp. 11. 12).

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* The United States Commission in 1878 took 14,000,000 salmon eggs, and reserved 2,500,000 of these for the McCloud to feed the fisheries of the Sacramento. As I have stated in the text, on several days, 9000 salmon were taken by the Commission. Assume that the fish taken on only one of these days, at only one station, on one tributary of the river, represented one-twentieth of the whole spawning stock of the Sacramento (it is very unlikely that they represented one-hundredth), 180,000 salmon must have spawned in the Sacramento basin. If half of them, or 90,000, were females, and each female carried 10,000 eggs, these female fish must have deposited among them 900,000,000 salmon eggs. Assume, further, that Nature, in her less perfect operations, only succeeded in hatching over 33 per cent. of the eggs, and that man, in his more perfect method, hatched over 80 per cent. of the eggs—Mr. Wilmot, a high authority, estimates the hatch at 75 per cent.—Nature's contribution to the stock of the Sacramento was 300,000,000 young salmon; man's contribution was 2,000,000. Is Nature or man to be credited with the marvellous productiveness of the river?

Thus far Sir J. Gibson Maitland. His argument is put so clearly, that it is easy to deal with it. The only authentic record with which I am acquainted of the return of smolts as salmon, is to be found in the figures of the Tweed Commissioners. I have already shown that one smolt out of every fifty marked was recaptured. At this rate, as fifty smolts are worth 25*s.*, and the one salmon is worth 5*s.*, the artificial culturist would spend 25*s.* in producing 5*s.* But I do not care to press this point, because Sir J. Gibson Maitland, who probably owns some of the finest rearing ponds in the world, and who carried off the special prize for rearing-ponds at the Exhibition, seems himself to doubt the policy of retaining the young fry till they are two years old. "The old idea in this country (he writes) was to turn out fish big enough . . . to take care of themselves. The results from the Stormontfield experiment at first, when everything was new and in working order, were sufficiently marked, but they have not been permanent; and if pisciculture had achieved no more, salmon culture in this country at least would be an interesting exotic, with magnificent results in some cases, far oftener with none." And he goes on, after referring to the American Commission, to show how the young fry may be distributed as fry, as yearlings, and as smolts, in different parts of the river.

Sir J. Gibson Maitland, therefore, seems impliedly to abandon the notion of retaining all the fry until they reach the smolt stage. It may be supposed, therefore, that he practically accepts the American conclusion, that it is wiser and better to turn the fish into the river as soon as the umbilical bag is absorbed. It is much more difficult to prove that this course may not be a very profitable one. Sir J. Gibson Maitland says that 2,000,000 young fry may be bred at an expenditure of less than £1000 a year. I am far from saying that such an expenditure may not be most wise and most advantageous. I only doubt whether the profit is so great as salmon culturists imagine. I suppose that it would not be an exaggerated estimate to assume that one-half of these fry turned into the river to take care of themselves would fall victims to trout, beetles, birds, and the many other enemies, to which they are exposed in the first year of their existence. I suppose it would also be a moderate estimate to assume that one-half the remainder would similarly perish in the second year of their existence. On the assumption, then, that all the surviving fry became smolts at two years, I imagine that I cannot be overstating the case when I say that out of the 2,000,000 fry there would not be more than 500,000 smolts. If the Tweed Commissioners' figures are right, that one salmon returns for 50 smolts, the 500,000 smolts might produce 10,000 salmon — take them at 5*s.* each (Sir J. Gibson Maitland's estimate), their value would be £2500. A result which is perhaps sufficiently encouraging, but is hardly what artificial culturists imagine.

But there is another way of looking at the matter. If 250 hen salmon had been allowed to spawn in the natural way, they would have produced say one-third as many fry as the artificial culturist. If 500 additional female salmon had accompanied them, they would have produced the same number of fry as the artificial culturist. The true question for the salmon culturist then to determine is not whether it is wise to spend £1000 in hatching 2,000,000 salmon artificially, but whether it is cheaper to hatch 2,000,000 salmon artificially or to protect 750 hen fish while they are spawning. I cannot myself imagine that in any river fairly stocked with fish it can cost upwards of £1 to protect each spawning hen fish.

I trust that, in making these remarks, I may not be understood as desiring in any way to depreciate the labours of the artificial culturist or to withhold from him the great praise which is due to his energy and skill. On the contrary, I fully recognise the good work which the artificial culturist has done (1) in naturalising (to use the usual though inappropriate term) new kinds of fish in different countries; (2) in restocking rivers which had been exhausted of the old supply. I equally admit that, if the Americans are right in ascribing the prosperity of the Sacramento to artificial culture, the artificial cultivation of salmon has been raised into a great commercial success. On this point, with no desire to depreciate this work, I have ventured to state the doubts which have occurred to my own mind. I have the satisfaction in doing so, in feeling that the expression of doubt cannot at any rate do harm. Philosophers say that almost every acquisition which man has made to his knowledge of nature has been won through doubt. In the calm atmosphere of faith in artificial culture, in which fish culturists live, the expression of a few doubts may possibly lead some of its disciples to dispel some of the clouds which still obscure the subject.

ECONOMIC CONDITION OF FISHERMEN.

I have now completed the task which I have undertaken. I have endeavoured to describe—as well as the collections at the Exhibition and the information procurable at it enabled me to do—some of the more important fisheries of the more important communities of the world; and I have attempted to draw some general conclusions from these descriptions, which may I hope be of some service to fishermen generally, and especially to fishermen of our own country. In doing so, I have confined myself to matters of immediate interest to fishermen; and I have not trespassed on the ground which Professor Lankester has covered in his paper on the "Scientific Results of the Exhibition." Before I conclude this Report, there is only one other subject on which it seems desirable to touch. The highest object of the Exhibition will not be secured if it does nothing to improve the condition of the fishermen employed in the fisheries. The Executive Committee accordingly wisely determined to devote one class to an illustration of what they called the economic condition of fishermen. They asked a statistician of distinction to write a short preface to that portion of the Catalogue; they requested him to read a paper on the same subject at one of the Conferences; and they secured his services as Chairman of the Jury to which the objects exhibited in the class were referred. It is, perhaps, a subject of regret that the public generally did not take more advantage of the opportunity, which was thus afforded to them, to illustrate the social life of a large and industrious section of Her Majesty's subjects. "We might wish," said the Jury, "that the Exhibition had been more complete in all that contributes to the social elevation of a class of persons pursuing a most useful calling, often distinguished by rare courage, and not unfrequently performing deeds of generosity and virtue."

Under these circumstances, it might, at first, seem impossible to add anything to what the Jury have written. But circumstances have given me some personal acquaintance with fishermen; I have enjoyed advantages, which few other persons out of their own class have shared, of observing their life, and of ascertaining their opinions; the

Exhibition has enabled me to obtain a little information on the subject of the fishermen of other countries, and, as the conclusions—which I have formed—differ from those expressed by Professor Levi, I venture to supplement his observations with some remarks of my own.

In the first place, I think it obvious from the Exhibition that the fishermen of most countries of the world are a very poor and very industrious class. Their poverty may be inferred from many little circumstances. The pains, for instance, which they take to use common objects in their pursuit, which nominally cost nothing, but which really entail upon them a considerable expense, illustrate my meaning. In Russia, for example, and in India, the fishermen use hand-made, instead of machine-made nets. There is, I suppose, no doubt whatever that, if the lowest possible value be placed on the fisherman's time, the hand-made net is a more costly article than the machine-made net. But the fisherman is so poor that much of his time is literally valueless; and he devotes his long hours accordingly to the tedious operation of making nets by hand. In the same way, cork and lead are probably the most efficient floats and sinkers for the nets. But, cheap as they are, the fishermen in many countries cannot afford to use them. It pays them to gather stones and bones for one purpose; and to collect pieces of wood or gourds for the other. They resort to any expedient, they spare no labour, to avoid the cost of purchasing articles which would be much more efficient instruments of their calling.

The same thing is true of their boats. I asked the Norwegian Commissioner why the fish carriers of Norway were still built with a single square sail, and with the round old fashioned bow which must make them slow sailers against a head wind. His reply was that, in practice, the slow boat only took three days to take what a fast boat would do in one day. I naturally said, surely in that case it would well repay to substitute a better boat, and thus save practically two days' wage out of every three of the crew. His answer disposed of my suggestion. Wages, he said, are very low in Norway. In other words, wages are so low that it does not literally pay to introduce improved appliances to make the labour more efficient. What is true in the case of Norway is, I believe, true in the case of other countries; and it may probably be assumed that, wherever fishing is conducted by old-fashioned, slow-sailing open boats, and with primitive appliances, the wages or earnings of the fishermen are small; and that, on the contrary, wherever large fast boats and good machinery are met with, the wages or earnings of the fishermen are high or higher.

Good boats and good fishing appliances are specially found in the British Islands and in the United States. Probably the United States is in advance of our own country in this respect. It would seem to follow that the fishermen of the United States should be better off than British fishermen; and this seems actually to be the case. "The American Collection" of fishermen's clothing, wrote the Jury, "is large, but incomplete. The lay figures of fishermen of different classes, as well as the photographs of groups of the same, seem to indicate a condition of comfort and intelligence greatly in advance of that of fishermen of the United Kingdom;" while in the same way, to quote another paragraph of the same report, "a series of photographs of fishermen's houses, exhibited by the American Commission, would seem to indicate, as in the case of the photographs of dress, a condition of comfort unattained by most fishermen in this country." The Jurors were, in fact, so much struck by the circumstance that they expressed a doubt "whether the American exhibits represent the fair average fishermen of the United States," and whether the houses, the photographs of which were exhibited, were not intended for masters and not for ordinary fishermen. It is unnecessary for me to attempt to settle the point. All that I am concerned in pointing out is, that the machinery for fishing in the British Islands and in the United States is superior to the machinery for fishing elsewhere; and that the social condition of fishermen in the British Islands and in the United States is in advance of the condition of the same class elsewhere. To this it may be added, that the machinery in the States is probably superior to the machinery in this country; and that the condition of the fishermen in the States is also probably superior to the condition of fishermen in this country.

On this point, however, it appears desirable to point out that Professor Leone Levi, who wrote the report, appears to have formed a very inaccurate idea of the condition of fishermen in this country. He places the gross value of the fish taken in the British Islands at £11,000,000: the fishermen's share of this take at £3,300,000; and the average earnings of the 120,000 fishermen, after deducting £500,000 for loss of gear, at £23 a year, or 9*s.* a week for each fisherman (Handbook. p. 22), while, in the preface to the Catalogue, he takes an even more gloomy view. "Of the £11,000,000 produced by the fisheries," he writes, "scarcely 30 per cent., or £3,000,000, go to the pockets of the fishermen: of the £270,000,000, the total produce of the land, at least 25 per cent., or about £70,000,000, are spent in wages, giving, in the case of the fishermen, about £10 a head, exclusive of incomes from other occupations, and, in the case of the agriculturist, about £21 per head a year." The fisherman, therefore is, according to Professor Levi, not half so well off as the ordinary agricultural labourer.

I do not think that any one who has any acquaintance with the fishing community will endorse this statement. If you examine an ordinary fisherman's dress, you will find that his clothes are warmer and more costly than that of the labourer; if you examine his food, you will find that he consumes a larger proportion of animal food than the labourer; if you examine the neighbourhood of any purely fishing village, you will find rows of cottages not merely occupied, but owned, by fishermen, built or purchased out of the profits of the fisheries If you make inquiries among the fishermen, you will find that many of them own their own nets and lines, and that some of them have a share in the boats in which they sail. If you ask the position of the masters, you will find that many of them are boat-owners—in other words capitalists, with £250 to £1500 of capital—who have begun their lives as ordinary fishermen. If you extend your inquiries to the farmers in the neighbourhood, you will find that they are in want of labourers, because the men are drawn from the farm to the fishing, not from the fishing to the farm. Perhaps you may even find people advocating exceptional legislation to punish labourers with imprisonment who break their engagements with the farmers, drawn away by the superior attractions of the fishing.

In all these points, Professor Levi will find strong evidence that the fisherman's lot is superior to that of the farm labourer. But, if he will go a little further, and take a Yarmouth, Eyemouth, or Peel fisherman, and place him side by side of a farm-labourer from any representative agricultural county, he will, I think, be struck with the difference. In stature, in physique, in education, in address, in, above all, independence, the fisherman, he will soon discover, excels the labourer. He could not excel him in any of these things if he was really living and bringing up his family on a miserable pittance of less than ten shillings a week.

What, then, are the average earnings of the average fisherman? From the inquiries which I have made in the part of Her Majesty's dominions in which I am writing, I am inclined to conclude that the fishermen here work on an average for about nine months' fishing, and earn in that period about £40 a head. But I do not wish to take the case of a single community. Professor Levi himself calculates the gross value of all the fish taken at £11,000,000, the gross value of all the capital employed at £10,000,000. Assuming that the capital employed earns 30 per cent. a year (Professor Levi is too good an economist to think it could earn more, without attracting large additions to the fishing fleet), £8,000,000 must remain for distribution after the capital has had its share. That, among 120,000 fishermen, represents a substantial profit of £67 a head. It is probable, however, that £11,000,000 is too large a sum to represent the value of the fish on the coasts. The lowest estimate of its value that has, I believe, ever been given is £8,000,000. In this case, £5,000,000 would remain for distribution among the fishermen, or rather more than £41 a head.

How, then, has Professor Levi fallen into his error? He seems to have been misled by a form of account which Mr. Sayer, a solicitor at Yarmouth, suggested to a Commission of 1881, that it should be obligatory in all cases for the master of a smack to fill up on each voyage. In this account the men's share is put down at about one-third of the value of the gross catch. But there is nothing in the account to show that the figures are based on fact, or intended for any purpose except that of illustrating the account. But, in the body of the report, from the appendix to which the account is taken, much more accurate information is forthcoming. The first witness gave the Commissioners account of an eight weeks' voyage of a certain smack, in which the first and second hand were paid in shares. The gross take was £106 8*s*. 6*d*., or, after deducting dock dues, &c., £102 15*s*. The captain's share for the eight weeks was £17 13*s*. 2*d*., or, after paying his food-bill, £12 13*s*. 3*d*.; the second hand's was £14, or, after the same deduction, £9 9*s*. The rest of the crew were paid by wages; and these wages for the third hand average, from 18*s*. to £1 a week; of the deck-boys, from 14*s*. to 16*s*.; of the cooks (usually the smallest boys) from 9*s*. to 10*s*. (Q. 76.) These three hands would have received, therefore, £2 2*s*. a week, or, for the eight weeks' voyage £16 16*s*. Their food would have cost about £13 10*s*. more. The crew of this vessel, therefore, received in wages and food £62 out of the £102 which she earned in her voyage, or very nearly two-thirds, instead of Professor Levi's one-third, of the vessel's earnings. The same thing may be inferred from the evidence given before the same Commission. A lad of twenty-three told the Commission he earned "about a pound a week" (Q. 917), and he added, that he had sailed with many masters, most of whom owned their own vessels.

These circumstances seem to me wholly opposed to Professor Levi's conclusion that British fishermen are living in a condition inferior to that of the Dorsetshire labourers. There may, no doubt, be poor fishermen in many parts of the British Islands, just as there are poor men in almost every rank of life. But the fishermen—the men who man the trawling fleet of Eastern and Southern England, and the drift boats of Eastern and Southern Britain, and of the Isle of Man, are not indigent; they earn, as a rule, fair wages; their earnings tend to increase with every improvement in the machinery of fishing. Sober and thrifty as a class, many of them rise to comparative independence, and obtain a comfortable provision for their old age as a reward for their hard labour.

These remarks, however, apply to regular fishermen; they are not necessarily applicable to a numerous class in Ireland and Western Scotland, who are half cottiers and half fishermen. Improved and costly appliances seem, in fact, to be more and more requisite for success in fishing; and men who combine other pursuits with fishing cannot, as a rule, afford the larger boats and better machinery which fishermen who do nothing but fish can afford to use.

Few people who have inquired into the history of sea fishing will doubt that the improvement which has taken place in the condition of the fishermen has occurred during the last forty years. It has been synchronous with the remarkable progress which has taken place in other industries and in the condition of other labourers. I am anxious to avoid anything which might have the appearance of a political argument, but I imagine that the repeal of the duties on salt, and of the timber duties, and of the import duty on cotton, has done more to encourage the progress of fishing than was effected by all the bounties of a previous generation. But it is not legislation alone to which improvement may be traced. The progress of machinery; the substitution of machine-made for hand-made nets; the substitution of cotton for hemp; the introduction of steam capstans; the construction of better, faster, and handier boats; the construction and the multiplication of railways,—

have all conspired, and are conspiring, to raise the condition of fishermen as a class; and the improvement in their condition is most visible in those great branches of the industry, such as trawling and driving, where the machinery has been improved the most, and is least visible among the hand-line fisherman, and the lobster and crab fishermen, who still use much the same appliances as were used by their forefathers.

The improvement, great as I believe it to have been, is, I trust, still progressing. It would not have occurred at all if a wise legislation had not left the fishermen free to follow their pursuits in their own way, without hampering them with unnecessary laws or fostering them with an injudicious patronage. It is in the great free communities of America and England that the trade of the fishermen is most prosperous. Some people may possibly recollect some noble lines, either by Pope or one of his coadjutors, in the translation of the 'Odyssey,' descriptive of the effects of a good government on agriculture and fishing. Though a series of unfavourable seasons has interfered with the produce of our fields, they seem still more applicable to Victoria of England than to Penelope of Ithaca:—

> "Oh Queen: whose far resounding fame
> Is bounded only by the starry frame—
> Consummate pattern of imperial sway,
> Whose pious rule a warlike race obey:
> In wavy gold thy summer vales are dress'd
> Thy autumns bend with copious fruit oppress'd;
> With flocks and herds each grassy plain is stor'd,
> *And fish of every fin thy seas afford:*
> Their affluent joys the grateful realms confess;
> And bless the Pow'r that still delights to bless."

S. WALPOLE.

31st January, 1884.

THE

INTERNATIONAL FISHERIES EXHIBITION, 1883.

STATEMENT OF RECEIPTS AND DISBURSEMENTS

From August 10*th*, 1881, *to November* 30*th*, 1884.

Statement of Receipts and Disbursements from

RECEIPTS.	£	s.	d.	£	s.	d.
To Donations—						
Royal Bounty Fund	200	0	0			
General..	8,502	18	0	8,702	18	0
,, Admissions to the Exhibition	..			117,869	10	10
,, Royalties	..			8,571	11	8
,, Sale of Catalogues and other Publications	..			6,462	2	4
,, Advertisements— Official Catalogues and other Publications	..			3,250	0	0
,, International Health Exhibition, 1884— Amount of Valuation of Plant, Fittings, and other Effects.. ..	..			1,564	5	8
,, Miscellaneous—						
Rent of Counters and Sale of Cloth for same	521	12	7			
Bath Chairs, for hire of	139	6	6			
Share of Profit on "Recipes for Cheap Dinners"	89	16	3			
Interest on Deposits	31	13	4	782	8	8
,, Fish Dining Room	..			5,403	4	1
Carried forward..	..		£	152,606	1	3

FISHERIES EXHIBITION, 1883. (178*c*)

10th August, 1881, *to 30th November*, 1884.

DISBURSEMENTS.	£	*s.*	*d.*	£	*s.*	*d.*
By Buildings..	..			47,243	7	11
,, Office Furniture and Fittings	..			465	18	2
,, Electric Lighting— Construction and Maintenance ..	..			10,407	3	5
,, Salaries and Honoraria—						
General Staff	2,858	0	0			
Superintendents	2,157	1	4			
City Office	585	16	8			
				5,600	18	0
,, Wages—						
Sweepers and Cleaners	3,430	2	10			
Gatekeepers	1,859	7	7			
Police	2,852	8	5			
Fire Brigade	423	16	3			
Watchmen	265	16	0			
Miscellaneous	138	13	4			
				8,970	4	5
,, Advertisements	..			11,045	0	0
,, Literary Department— Salaries, Copyrights, Printing Catalogues, Programmes, Handbooks, Essays, &c.	15,723	15	7			
Less unpaid	2,404	9	11			
				13,319	5	8
,, Juries and Conferences	..			3,932	16	4
,, Awards to Exhibitors—						
Money	2,587	10	0			
Medals	3,985	6	6			
				6,572	16	6
,, Printing (General) Stationery Books, including Tickets and Passes ..	..			3,451	19	11
,, Commission—						
On Sale of Catalogues and other Publications	2,154	0	9			
On Advertisements inserted in ditto..	1,000	0	0			
				3,154	0	9
,, Exhibits— Expenses in connexion with receipt and delivery of	..			1,711	15	11
,, Rent—						
Exhibition Commissioners, 1851 ..	4,000	0	0			
No. 24, Haymarket (Temporary Offices)	466	13	4			
				4,466	13	4
,, Royal Horticultural Society— Proportion of receipts on Flower Show days	..			2,768	3	9
Carried forward..	..		£	123,110	4	1

RECEIPTS.	£ s. d.	£ s. d.
Brought forward	..	152,606 1 3
To International Health Exhibition 1884— Rent of Buildings	..	5,000 0 0
To Sundry Loans	34,500 0 0	..
	£	157,606 1 3

Examined and found correct.—LOVELOCK & H. W. S. WHIFFIN,
19, COLEMAN STREET, Chartered Accountants,
1*st December*, 1884. *Auditors.*

DISBURSEMENTS.	£	s.	d.	£	s.	d.
Brought forward				123,110	4	1
By Opening Ceremony and Conversazione				651	18	5
,, Garden, and Garden Illuminations				1,879	9	6
,, Military Bands				5,255	18	11
,, Aquarium				1,649	14	10
,, Water				1,373	0	8
,, Gas				307	17	1
,, Parochial Rates				600	0	0
,, Fire Insurance				216	17	3
,, Travelling				217	17	10
,, Postages and Telegrams				287	4	7
,, Office, and Incidentals	785	7	5			
,, Do. City Office	216	16	8	1,002	4	1
,, Miscellaneous—						
Cloth for Counters	283	3	8			
Bath Chairs, Wages and Hire	143	9	0	426	12	8
,, Interest on Loans				784	6	9
,, Fish Dining Room— Expenditure for Fish, Oil, and other Provisions, Salaries and Wages				4,528	0	11
				142,291	7	7
,, Sundry Loans, repaid	34,500	0	0			
,, The National Training School of Cookery— Paid to them in respect of Profit "Fish Dining Room"				875	3	2
,, Awarded out of Surplus—						
Royal Fund for Relief of Orphans of Sea Fishermen				10,000	0	0
Royal Fisheries Society				3,000	0	0
,, Cash with Messrs. Coutts & Co.				1,439	10	6
			£	157,606	1	3

Edward Birkbeck,
Chairman of the Executive Committee.

SPECIAL REPORT

ON THE

ELECTRIC LIGHTING

OF THE

EXHIBITION.

SPECIAL REPORT

ON THE

ELECTRIC LIGHTING

OF THE

EXHIBITION.

In drawing up this Report my endeavour has been to deduce from the experiences of the Exhibition as much practical information as possible.

The data upon which this Report is based are those which were tabulated in the daily records of running, together with such electrical information as has been furnished by the exhibitors of the machines, supplemented by such published tests as are available of machines of the several types used.

It is a great source of regret to me that the Society of Telegraph Engineers and Electricians did not see their way to meet the wishes of the Executive Committee of the Exhibition, so as to carry out tests with the different machines, and to verify the electrical and other circumstances under which they had been running during the Exhibition. Had this been done, the data of running which are dealt with in this Report would have been of double value. As it is, the electrical data are supplied by my own personal valuations, taken from time to time with the several machines during the hours of running, which, as they were carried out under circumstances not admitting of great accuracy of result, must be looked upon as scientifically approximate only, although for practical purposes sufficiently indicatory to be of some value.

The Society of Telegraph Engineers and Electricians in declining to undertake the tests, considered that their Report would be of no value, as the time at which they were asked to carry out the experiments was too late, the Exhibition being about to close. I am sure that if these gentlemen had looked at the *practical* side of the question, and had considered that all the machinery present was doing its utmost to prevent break-down, the result of which would have been to throw crowds of people into darkness at a great risk, they would not have taken this position. They would, on the contrary, have recognised the impossibility, under the circumstances, of attempting any experiments till after the close of the Exhibition, when, with the machines in the exact condition in which they had been while carrying out the work, the duty done by them could have been easily and thoroughly examined, measured, and tested and verified.

In criticising the performances of the machinery throughout, it must be borne in mind that the date at which it was decided to light the Exhibition by electricity was about the end of February, and the Exhibition was to be opened on May 1st. Such a short space of time was manifestly inadequate for the building of sheds, the putting down of 1000 H.P. engines and boiler power, with all the attendant shafting, pulleys, &c., and the arrangement and carrying into effect of a series of systems of lighting, in which about 390 arc lamps and 3000 incandescent lamps were to be maintained alight, and which necessitated the erection of nearly 75 miles' length of mains and service wires. The several exhibitors taking part were hardly, moreover, able to decide exactly what their mechanical requirements might be, either as to power required or as to mechanical arrangements for speed; this in its turn delayed the arrangements for spacing and distribution of *dynamo* room, and apportionment of power, and led to a want of economy in the application of the power at command, which taxed the energies of all concerned in carrying through the lighting successfully.

Whilst in every way recognising the very cordial support and thorough co-operation of the exhibitors, I cannot but feel that the authorities were placed in a very disadvantageous position by the non-fulfilment of promises and undertakings made by certain of them.

The supply of the engines and boilers for motive power —first fixed at 700 H.P., but afterwards raised to 1000 H.P., on account of additions to the buildings and other causes—was very spiritedly undertaken by Messrs. Davey, Paxman and Co., several other firms refusing on the ground of inadequate time. This firm actually designed and built two large engines—one horizontal, one compound —specially for the Exhibition, getting the first to work within ten weeks of the date of order (their works being kept going night and day for three weeks to complete it), and the second about a fortnight later.

Of the electric exhibitors those who showed the greatest promptitude were Messrs. Siemens, who carried out the brilliant and effective lighting of the main gallery by means of incandescent lamps on each of the points on the semicircular girders of the roof. This plan, which was suggested by C. E. Spagnoletti, Esq., C.E., gave a very effective illumination, although of less illuminating value than if arc lights had been used. The installation was ready within a few days of the opening of the Exhibition, but was not used for public lighting till the beginning of June.

The Jablochkoff Company also commenced their effective installation in good time, but were much delayed in completing it through having to manufacture the lamps required, of which they had not a sufficient number in stock.

The Gülcher Company spared no efforts to complete their installation, and although these efforts were not crowned with such success as was anticipated, through certain electrical drawbacks, the Committee of the Exhibition are much indebted to them for the cordial and prompt manner in which they commenced and carried out their work, and the unsparing energy shewn by them in meeting the requirements of the Exhibition throughout its whole course.

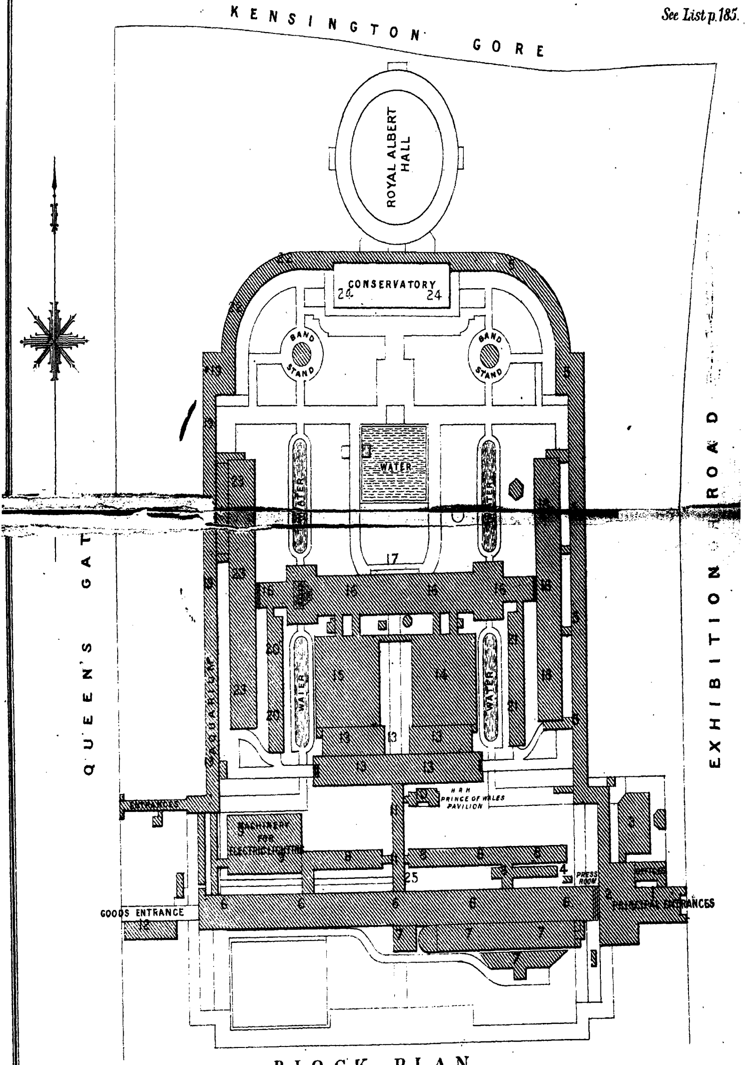
The very effective installation of Lea Arc lamps, furnished by Mr. S. J. Mackie, in Canada and the United States, was promptly in action, one portion, indeed, having been kindly placed at the disposal of the Exhibition authorities for night-work before opening.

The successive completion of the Elphinstone-Vincent, Lever, Brockie, Gérard and Hochhausen installations ultimately allowed of the Exhibition being thrown open to the public at night on the 1st of July. From that date till October 31st it was nightly lit, with the successive additions of the Ferranti, the Willard, the Electric Light Supply Company, the Unipolar Company, and the Pilsen installations, so that for the last month of the Exhibition the lighting in amount and disposal was as follows :—

GREAT INTERNATIONAL FISHERIES EXHIBITION, 1883.

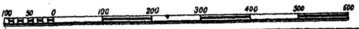
DISTRIBUTION OF SYSTEMS OF ELECTRIC LIGHTING.

See List p. 185.



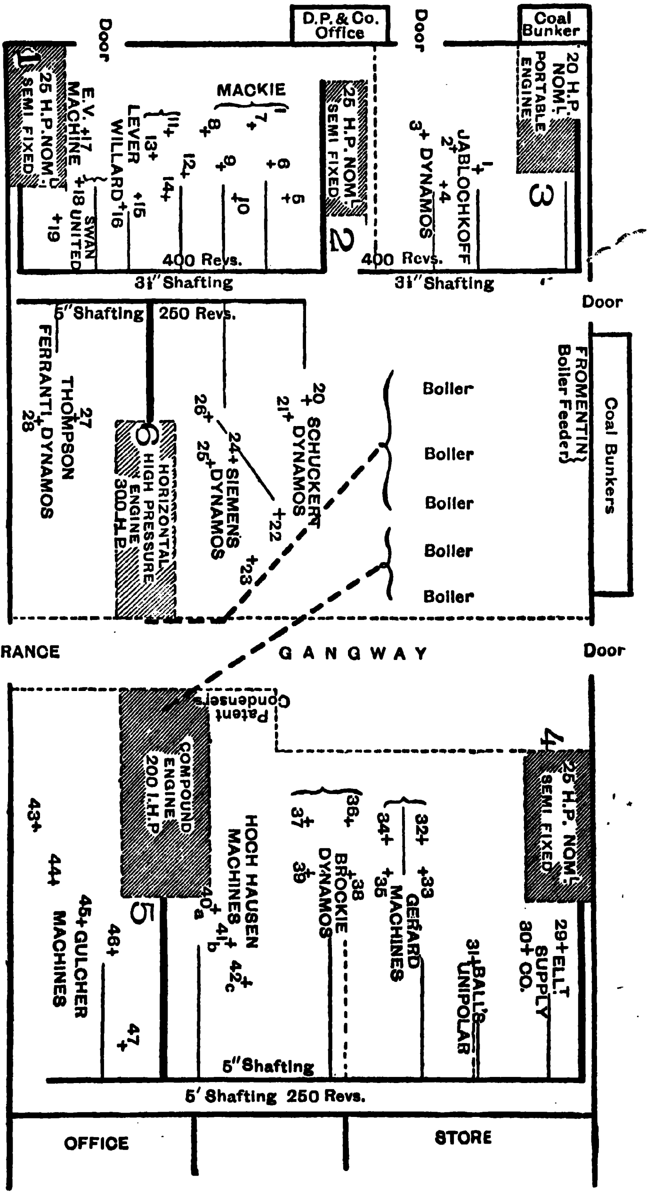
BLOCK PLAN.

SCALE OF FEET.



LIST OF LIGHTING.

Reference No.	Sections. (See Plan of Buildings.)	Systems of Light.	Lights.		No. of Dynamos on List (see Plan of Shed).
			Arcs.	Incandescent.	
1	Vestibule	Elphinstone-Vincent	...	200	19
2	Fine Arts Gallery		...	120	
3	Fish Market	Ball's Unipolar	5	...	31
4	Literary Superintendent's Room	Electric Light Supply Co.	...	40	30
5	Eastern Corridor	Edmunds	15	...	41
6	Deep Sea Fisheries	Siemens	...	1040	22, 23, 24, 25
7	Dining Rooms	Lever	28	...	11, 12, 13, 14
8	Lifeboat Shed	Electric Light Supply Co.	5	...	29
9	Machinery in Motion and Electric Light Shed	Gülcher Co.	23	...	43
10	Prince of Wales's Pavilion	Swan Co.	...	190	17, 18
11	Prince of Wales's Corridor	Ball's Unipolar	2	...	31
12	Third Class Refreshment Room	Brockie	1	...	39
13	Netherlands, Denmark	Jablochkoff	48	...	1
13	Belgium, Newfoundland	Jablochkoff		...	2
13	Part Canada and United States	Jablochkoff	12	...	3
13	Avenue	Jablochkoff	4	...	4
14	Norway and Sweden	Brockie	14	...	36, 37, 38
15	Canada and United States	Mackie (Lea)	15	...	5, 6, 7, 8
16	Promenade	Edmunds	25	...	40
17	Mast	Edmunds	6	...	42
18	China	Gülcher Co.	...	602	44, 45, 46, 47
19	Aquarium and Western Corridor	Ferranti, Thompson, and Co.	...	500	27, 28
20	Russia	Gérard	7	...	32, 34
21	Spain	Gérard	8	...	33, 35
22	Western Quadrant	Willard	6	...	15, 16
23	Western Gallery	Pilsen Joel Co.	26	...	20, 21
24	Conservatory	Siemens	4	...	26
	Priestman's Stand	Brockie	1	...	...
25	Fisherman's Home	Mackie	...	37	9, 10
	Allen's Cottage	Mackie	10	...	9, 10
			252	2629	...



MACHINERY IN MOTION

No. of Machine.	NAME OF EXHIBITOR.	Description of Machine.	Description of Lighting done by Machine.	Ampére Current.	E. M. F.	Revolutions per Minute.	Carbon used.	
							Top.	Bottom.
1	Jablochkoff Electric Light Company.	Self-exciting compound alternating - currrent Gramme machine.	On each 20 Jablochkoff candles arranged 4 circuits of 5 each.	4×7=28	250	1100	4 mm.	4 mm.
2	,,	,,	,,	,,	,,	,,	,,	,,
3	,,	,,	,,	,,	,,	,,	,,	,,
4	,,	,,	,,	,,	,,	,,	,,	,,
5	S. J. Mackie, Esq., for the Electric Light and Power Agency.	E Gramme direct current high tension machine, excited by No. 9 and 10.	5 Lea c. p. arc lamps each (nom. 2500).	21	185	1050	12 mm.	20 mm.
6	. .	. .	. .	21	..	..	12 mm.	20 mm.
7	. .	. .	. .	21	..	..	12 mm.	20 mm.
8	. .	Do.	48 incan.	..	..	..	Incan. lamps.	
9	. .	A Grammes continuous.	Exciting 5·6 . . .	21	60	1050	Exciter.	
10	. .	. .	7·8	21	..	1050	Exciter.	
11	C. Lever	Bürgin continuous current, high tension.	6 arc lamps c. p. (nom. 800).	22	160	1400	10 mm.	10 mm.
12	. .	. .	6 Do. do.	..	..	..	10 mm.	10 mm.
13	. .	Gramme shunt - wound continuous current, high tension.	8 Do. do.	12	280	1350	10 mm.	10 mm.
14	. .	. .	8 Do. do.	..	..	..	10 mm.	10 mm.
15	Willard	Bürgin continuous current, high tension.	3 Willard c. p. arc lamps (nom. 1000).	16	180	..	15 mm.	15 mm.
16	. .	Do.	Do.	..	..	..	..	..

No. of Machine.	NAME OF EXHIBITOR.	Description of Machine.	Description of Lighting done by Machine.	Ampére Current.	E. M. F.	Revolutions per Minute.	Carbon used.	
							Top.	Bottom.
17	Swan United Electric Light Company.	Siemens' W I. alternating current machine, externally excited.	185 82 volt 20 c. p. Swan incan. lamps .	150	85	800	Incan. lamps.	
18	. .	Siemens' continuous current machine, exciting 17.	. .	21	..	1050	Exciter.	
19	Messrs. Elphinstone and Vincent.	Elphinstone-Vincent continuous current machine.	335 42 volt (20 c. p.) Woodhouse and Rawson incan. lamps.	200	95	950	Incan. lamps.	
20	Pilsen - Joel Electric Light Company, Limited.	Schückert continuous current, high tension machine.	13 Pilsen c. p. arc lamps (1000 nom.).	7	620	950	10 mm.	10 mm.
21	. .	Do.	Do.	7	620	950	10 mm.	10 mm.
22	Messrs. Siemens Brothers and Co.	Siemens' W o. alternating current machine, externally excited.	540 20 c. p. volt Swan incan. lamps.	170	160	610	Incandescence.	
23	. .	Do.	Do.	..	9	..	Incandescence.	
24	. .	Continuous current machine.	Exciting 22 . . .	24·5	120	950	Exciter.	
25	. .	Do.	Exciting 23.	..	..	..	Exciter.	
26	. .	Continuous current . .	Burning 4 arc lamps in parallel circuit of 5000 c. p. each.	169	79	660	18 mm.	15 mm.
27	Messrs. Thompson, Ferranti, and Ince.	Ferranti alternating current machine, externally excited.	450 to 300 volt incan. lamps.	3	84	..	Incan. lamps.	
28	. .	Siemens' continuous current machine.	Exciting No. 27 . .	22	45	980	Exciter.	

29	Electric Lighting and Supply Company.	Francklin-Bürgin continuous current machine, low tension.	45 volt incan. lamps .	..	220	1300	Incan. lamps.	
30	. .	Francklin-Bürgin continuous current, high tension machine.	6 Jarman arc lamps 1000 c. p. each	18	..	..	14 mm.	14 mm.
31	Ball's Unipolar Company	Ball's continuous current, high tension.	7 Ball's arc lamps 1000 c. p.	13	240	1450	12 mm.	12 mm.
32	Gérard Electric Light Company.	Siemens' W. alternating current machine, excited by 34.	8 Gérard arc lamps 1200 c. p.	17	400	920	12 mm.	12 mm.
33	. .	Gérard alternating current machine, excited by 35.	8 Gérard arc lamps 1200 c. p.	17	65	800	12 mm.	12 mm.
34	. .	Siemens' continuous current machine.	Exciting No. 32 . .	21	..	..	Exciter.	
35	.	Do.	Do. No. 33 . .	..	..	..	Exciter.	
36	British Electric Light Company.	Gramme continuous current, high tension.	7 Brockie arc lamps 2100 c. p. (2500).	16	250	900	13 mm.	13 mm.
37	. .	Do.	8 Brockie arc lamps 2100 c. p.	16	250	900	13 mm.	13 mm.
38	. .	Do.	Fxciting 36, 37 . .	22	..	1150	Exciter.	
39	. .	Do.	Single arc lamp Brockie c. p. (3000 nom.).	22	..	1150	18 mm.	18 mm.
40	Henry Edmunds . . .	Hochhausen continuous current, high tension.	25 H. H. arc lamps c. p. (1000 nom.).	10	1250	950	11 mm.	11 mm.
41	. .	Do.	15 H. H. arc lamps 1000 c. p.	10	750	1000	11 mm.	11 mm.
42	. .	Do.	6 H. H. arc lamps c. p. (3000 nom.).	22	750	..	16 mm.	16 mm.
43	Gülcher Electric Light Company.	Gülcher continuous current, low tension.	22 Gülcher arc lamps (nom. 500 c. p.).	143	65	700	10 mm.	10 mm.
44	. .	Do.	602 Crooke's incan. lamps, 16 c. p.	240	65	700	Incan. lamps.	
45	. .	Do.		240	65	700	Incan. lamps.	
46	. .	Do.		240	65	700	Incan. lamps.	
47	. .	Do.						

ENGINES AND MECHANICAL ARRANGEMENTS.

Meanwhile Messrs. Davey, Paxman and Co. had supplied in their shed the following engine-power:—

No. 1. 25 HP. nom. semifixed, driving ..	Elphinstone-Vincent, and Woodhouse and Rawson, Lever, Mackie, Lea, and Willard systems.
„ 2. 25 HP. nom. semifixed „ ..	
„ 3. 16 HP. nom. semifixed „ ..	Jablochkoff system.
„ 4. Semifixed 25 HP. nom. „ ..	Electric Light Supply Company, Unipolar, Brockie, Hochhausen, Gérard system and Gülcher systems.
„ 5. Compound 60 HP. nom. indicating 200 HP., driving ..	
„ 6. Horizontal 80 HP. nom. indicating 350 HP., driving ..	Siemens, Ferranti, Pilsen and Swan systems.

Before turning to the electrical data, the arrangements of the shed for mechanical power should be described.

In laying out the shed it was found impossible to drive with a tight under-belt throughout; and as the tight under-belt was in all cases kept preferably between the engine and shafting, the dynamos, with few exceptions (where crossed belts, &c., were used), ran with a slack under-belt, and the coefficient of slip was consequently higher than was desirable. On the other hand, the class of belting used (Oldfield and Walton link belting, of which I cannot speak too highly) to a considerable extent reduced this loss.

The dynamos were grouped to drive from four sets of shafting; two, of 3½ inches diameter, running at a mean speed of 400 revolutions per minute, and two, of 5 inches diameter, at a mean of 250 revolutions per minute. The former were designed to drive the lighter dynamos, and were driven by the light semi-portable engines 1, 2, 3; while the latter were intended for the transmission of power from the horizontal and compound engines 5 and 6 (see Plan).

In carrying out the first group of $3\frac{1}{2}$ inches shafting, it was arranged as coupling Nos. 1 and 2 engines, each driving one end of the shafting. The object of this was that if one engine broke down it could be disconnected, while the remaining engine could light portions of all the sections on the shafting, and so prevent total cutting off of light in the buildings, which would have occurred had dependence been placed on the one engine alone. In practice, however, this advantage was not very clearly shown, while the concomitant disadvantages of irregularity of speed, through want of balance between the two engines, was very marked.

In the same manner No. 4 was coupled on to the shaft driven from the compound No. 5, in order to help it, if overloaded, and to save entire breakdown. But in this case also, the arrangement in no way contributed advantageously to the practical work of lighting, and would have been better otherwise carried out.

The large horizontal engine No. 6, which was intended to supply the power for our leading and most effective lighting, viz., the 1080 lights by Messrs. Siemens, the Conservatory by the same firm, the Pavilion by the Swan United Co., and the Aquarium, &c., with 1000 lights by the Ferranti machine, never was pressed to its full power, as the latter machine was only prepared late in the day, and then was never worked to a greater duty than 650 lights; which number was only maintained for a few days, gradually falling to 350. This was the more to be regretted as a position in the shed had been assigned to it, on account of the 130 H.-P. expected to be absorbed by it, which otherwise would have been more advantageously occupied. The H.-P. therefore available on this engine remained throughout the Exhibition always about 70 to 100 within its effective possibility, although two Schuckert machines, driving 26 Pilsen lamps, during the last six weeks of the Exhibition, which absorbed about 32 H.-P., were added. The engine was served by three locomotive boilers working at 80 lbs. pressure, each of which would work up to 120 H.-P. without undue strain.

The compound engine No. 5, which was built to indicate 250 H.-P., as before stated, worked at a disadvantage throughout, having just too much load on her to work efficiently, the more so that the patent condenser, which was expected by its action to give a margin of power, never could be used with reliance, and 20 to 23 H.-P. was thereby lost. The boilers serving this engine were one 40 H.-P. and one 20 H.-P. locomotive type high-pressure boiler, working at 120 lbs. on the inch, generating 220 H.-P. The small boiler was adopted in lieu of a pair of 40 H.-P., the time being too short to prepare a second 40 H.-P. boiler, and it was believed that this would have been sufficient, as undoubtedly it would have been, had not the compound been overloaded and unable to rely upon its condenser.

I may mention also that in view of the desire of Messrs. Davey, Paxman, and Co., to abate as much as possible any smoke nuisance, the boilers had been designed for burning a mixture of coke and coal, but in practice Messrs. Hardman and Son's Powel Duffryn smokeless coal was used with very powerful effect, both as to steaming power and as to smokeless consumption of fuel. The design of the boilers, however, as above, did not fit the new fuel adopted, and their efficiency, both as to steaming and smoke consumption, was deteriorated. The fuel supplied gave, nevertheless, very satisfactory results, and the quantity consumed did not exceed, even under these circumstances, about 3·3 lbs. of coal to the indicated horse-power.

The compound engine No. 5 was specially designed by Messrs. Davey, Paxman, and Co., and built for the Exhibition, and it is to be regretted that circumstances, as explained above, did not permit of its full advantages being demonstrated.

Completing my notice of mechanical apparatus, mention may be made of the 5-inch shafting and standards supplied by Mr. A. G. Mumford, of Colchester; of the pulleys driving the machinery, which were Roger's Wrought Iron Drums, constructed and *lent* by Messrs. Hudswell, Clarke, and Co., of Leeds; and of the patent cylinder lubricators by Messrs. Baird and Co., on the compound engine No. 5, and on the horizontal engine No. 6, which acted very effectively.

For the purpose of checking the speed of the countershafts, a Buss Tachymeter was fitted to each one, and on one of the Gramme machines driving the Brockie lights a Stroudley's Hydraulic Speed Indicator was also fitted.

Samper's Patent Pulley Grippers were fitted to the main driving-belts of Nos. 1 and 2 engines and to the driving-belts of all the Gülcher machines (one machine, absorbing 20 horse-power, having only 5 feet 6 inch centres), also to those of the Gérard machines. Their applicability to cases where belt slipping is liable to occur was evident, but there is no reason to believe that the advantage in power claimed by the inventor (Don Samper) is obtained. The grippers were also fitted on to the main belt of the compound engine, and were used on trial on two afternoons, but I did not think the advantage apparently to be gained by their use in any way counterbalanced the risk of a break-down or failure of the light in those sections driven by this engine, and I determined not to adopt them for the practical work of the Exhibition.

The steam-pipes were covered by Messrs. Leroy and Co., and by Messrs. Frederick Jones and Co., agents to the Silicate Cotton Company; no determination was made with regard to the relative economic effects of these coverings as to waste of heat, but that of the former firm seemed to be more practical of application, and to permit of a neater finish.

The boiler service of water for the boilers supplying the horizontal engine No. 6, was performed by a new piece of feed apparatus called the "Fromentin," which is automatic in its action, and maintains the water-level of the boilers unfailingly, and whatever the evaporation going on, whether slow or fast. This apparatus is well worth attention by all users of High-Pressure Steam.

ELECTRIC MACHINERY.

In dealing with the electrical portion of the installations, it will be advisable to classify it in two divisions, viz., those of Arc and those of Incandescence Lamps. These again may be subdivided into those driven by alternating and those by continuous current machines; the latter being further divided into machines of high tension, say over 400 volts, medium, from 100 to 400 volts, and low tension under 100 volts.

Classified in this way, we have:—

A. INCANDESCENCE LIGHTING.

I. By Alternating Currents.

Machines.	Lamps.	
1. 2 Siemens W.o. o. D.; v.	4 in series ..	1080 Swan, 46 volts.
2. 1 Ferranti (1000 Lt.)	2 in series ..	350 Swan, 41 volts.
	2 in series ..	150 Wright and Mackie, 41 volts.
3. 1 Siemens W 1. D 7.	parallel ..	180 Swan (82 volts).

II. By Continuous Currents.

1. 1 Gramme	parallel ..	37 Wright and Mackie (45 volts)
2. 1 Francklin-Bürgin	4 in series ..	40 Swan.
3. 1 Elphinstone-Vincent	2 in series ..	320 Woodhouse and Rawson, 42 volts.
4. 4 Gülcher	parallel ..	570 Crookes, 45 volts.

B. ARC LIGHTING.

I. By Alternating Currents.

1. 4 Jablochkoff-Gramme	5 in series ..	80 Jablochkoff.
2. 1 Gérard	8 parallel ..	8 Gérard.
1 Siemens W. 2.	7 in series ..	7 Gérard.

II. By Continuous Currents.

a. Of Low Tension (under 100 volts).

1. 1 Gülcher (No. 4) ..	in parallel ..	22 Gülcher.
2. 1 Siemens, D.	do. ..	4 Siemens.
3. 1 Gramme	.. ..	1 Brockie.

b. Of Medium Tension (100 to 400 volts).

1. Francklin-Bürgin ..	in series ..	5 Jarman.
2. 1 Ball's Unipolar ..	in series ..	7 Ball's.
3. 2 Gramme (E)	7 in series ..	14 Brockie.
4. 2 Gramme	8 in series ..	16 Lever.
2 Bürgin	6 in series ..	12 Lever.
5. 3 Gramme	5 in series ..	15 Lea.
6. 2 Bürgin	3 in series ..	6 Willard.

c. Of High Tension (over 400 volts).

1. 2 Schückert ..	13 in series ..	26 Pilsen.
2. 1 Hochhausen ..	25 in series ..	25 Hochhausen.
1 do ..	15 in series ..	15 do.
1 do. ..	6 in series ..	6 do.

It will be seen from the above tables that every phase of electric lighting had more than one exponent, and therefore that the first general deduction from the Exhibition is, *that electric lighting may be carried out efficiently and continuously, not by one system only, but by many.*

Such a deduction is undoubtedly a very valuable one, since it is based upon the continuous records of over four months' running for public lighting. This fact lifts Electric Lighting at once and for ever from the sphere of experiment to that of practical value, and demonstrates that, for the efficient illumination in a temporary manner of large spaces such as Exhibitions, the Electric Light has already taken the place of its competitor, Gas.

I now proceed to give details of the arrangements of the various systems in the order in which they appear in the above table, and I commence with a description of—

A.—INCANDESCENCE LIGHTING. 1. BY ALTERNATING CURRENT MACHINES.

1. *Siemens-Swan System.*

This system lighted the Deep-Sea Fisheries Gallery of the Exhibition, a space of 840 feet long by 50 feet wide, with an area of 42,000 square feet. There were used, as originally arranged, 1080 lamps, Swan 20 c.p., 46 volts, giving about 16 candle-power in ordinary working, in all 17,280 c.p., or about 3 c.p. per square foot of floor space. The lamps were arranged one on each point of the straining pieces, terminating in points (of which there were thirteen in each) in the semicircular wood girders upon which the roof and the walls of the Gallery were supported. The mean height of these points from the flooring was 26 feet, and the girders, which were 10 feet apart, and equidistant throughout, were eighty-three in number in the length of the Gallery. The illumination of this Gallery was very good, and there was no shadow upon the objects exhibited, whilst the labels and other printed information concerning exhibits might be easily read. On the other hand, the perspective effect of the 13 points of light arranged symmetrically on the eighty-three semicircular girders, gave a unique and novel effect, the *coup d'œil* of which quite raised the expectation of the public on entering the building on the score of illumination alone, apart from the general interest of the Fisheries. The thanks of the Committee are due to Messrs. Siemens Bros., who merit the highest praise, not only for the liberal spirit in which they came forward to take up a part of the lighting in so bold and novel a manner, but also for the thorough and efficient way in which the work was carried out, assuring successful continuance of the lighting of that part of the building assigned to them throughout the whole period of the Exhibition without any hitch.

The installation consisted of two alternating current W.O. Siemens' machines, each supplying 540 lamps, and excited by a Siemens' continuous D 2 machine. The lamps (of 46 volts) were placed in compound parallel of 4 series, and the circuits of the two machines used were so arranged that each alternate girder or set of 13 lights was on the same machine. By this means, if one machine had broken down, the Gallery would have remained equally illuminated throughout, although the intensity of the light would, of course, have been diminished.

The leads inside the building were of naked copper, stranded 19–16 B. W. G., supported on insulators. At each girder the service wires, 7½ mm. diameter, carrying thirteen lamps, were connected with a simple cut-out of lead wire; these, on the few occasions upon which they were required to act, did so most efficiently.

The cut-outs were two stout brass connections on each end of a separating glass tube, about 2½ inches long, which enclosed the lead wire.

The return mains were conducted outside the buildings through 3 stranded 19·16 B. W. G. naked wire, supported on insulators.

The dynamos used were of the ordinary Siemens alternating disc type, having 24 segments, running at 610 revolutions per minute, and giving at that speed a current of 170 ampères, with E. M. F. 180 volts, the exciters, under these conditions, with 900 revolutions, giving 27 ampères current, and E. M. F. 140. During the whole course of the Exhibition (five months), the only stoppage which took place was through the setting fast of a bearing, on account of neglect in the supply of oil.

The power indicated required to drive these machines and their exciters was 128 H.-P.

The total number of hours run by this installation with full work on was 505½ hours. The lamps broken during the Exhibition were as follows :—

Accidentally Broken		29
Electrical Failure, June	18	..
„ „ July	9	..
„ „ August	4	..
„ „ September	4	..
„ „ October	8	..
Total .. .. { Electrical	43	
Accidental }	29	
or an average of { 4½ per cent. Electrical 2½ per cent. Accidental }	72	

This installation afforded a crucial test of the possibility of arranging the lighting of a district, so that equal light should be given at each lamp ; for the 1080 lamps, each of which had the same brilliancy, whether as compared amongst themselves or as at distances near or quite close to the dynamos, might be well taken to represent a street of 42 houses, each with 25 lights and a frontage of 40 feet, which would be much the type of house to house lighting required in the adjacent district of South Kensington.

The cost of this installation appears in Appendix B.

A I.—ALTERNATING CURRENT MACHINES.

2. *Ferranti-Thomson Dynamo.* (*Exhibited by Messrs. Ferranti, Thompson & Ince.*)

Swan-Lamps; Wright and Mackie-Lamps.

In laying out their installation originally, the intention of this firm was to show one of their recently-invented dynamos, sustaining 1000 Swan 20 c.-p. lamps; and for this purpose the Aquarium and Western Corridor, inclusive of the A Bar in the Western Quadrant, were assigned to them. Space and available power also were retained in the engine-shed, at some inconvenience, for the purpose of driving this machine, which, from its proposed compactness and high electrical duty of 1000 lamps, was rightly looked upon as likely to prove the greatest electrical attraction of the Exhibition.

The lamps (1000) were to be 45-volt Swan 20 c.-p. lamps, arranged in 2 parallel series; and the cables for the installation were calculated to carry the large current of nearly 700 ampères requisite for sustaining 500 lamps. The cables were of two different dimensions, the larger, which was for the first or home half of the installation, being designed to carry the full current, 700 ampères; while the second, which was the prolongation of the first, was designed to carry half the current, 350. The sections respectively were 19 strand No. 5, and 19 strand No. 9. (This cable was prepared specially for the Exhibition by the Henley

Telegraph Works Co.) Mr. Ferranti used the proportion of 625 ampères to the square inch of section of copper strand. The lights were arranged as follows: for the lighting of the marine and freshwater fish Aquaria, to each tank 12 lamps; for the side tanks, 2 to each; for the corridor 10 very elegant electroliers, carrying 16 lamps each, were designed; and similar electroliers and brackets in the A Bar and Fish-Culture section. These fittings were by Messrs. Barwell, Son, and Fisher, of Birmingham.

The lighting of the Aquaria was most successful and effective, and for purposes of examination of their contents was even more efficient than daylight. The 12 lamps lighting each tank were arranged in two parallel series of 6 each, on a board, and were placed about 4 inches from the surface of the water, and about 1 foot from the back edge of the tank, so that the spectator, standing in front of the tank and looking through the glass, was conscious of a strong and equal illumination of the contents of the tank without the lights themselves being visible.

In consequence of delays in the perfecting of the machine intended to be sent to the Exhibition, the fittings, although ready, remained for a long time unused; but upon its being represented that such a state of things was prejudicial to the Exhibition, the firm sent down a 300-light machine to light up, at all events, the Aquaria, which it did successfully and without any breakdown. For the time being it was placed upon the *compound engine* No. 5, and was driven at a speed of 1750 revolutions per minute, being excited by a Siemens D 6 machine, giving 22 ampères, and running at 1300 revolutions.

This machine continued to do very good duty for some weeks, but about six weeks before the close of the Exhibition it was announced that the 1000-light machine was ready, and it was sent down to the Exhibition shed to be erected. Upon discussion, however, it appeared that, in order to get the number of revolutions requisite to give 1000 lamps, the size of the pulleys required to be made to fit the driving-shaft would be 8 feet 2 inches, and wheel races would require to be cut to admit of driving by belt. On reference to Messrs. Hudswell, Clarke & Co., who supplied all the pulleys, it was found they could not deliver those needed under a month, and that they would cost £30. Under these circumstances, as barely a month of the lighting would remain, and as there was no room to arrange intermediate countergear, it was decided to use smaller pulleys (which were ready), and to be content to drive only 650 lamps, which, at the speed thus attained, it was estimated the machine would maintain.

With this load on there were no tests taken, and the number of lamps, through constant breakages, and few replacements, gradually fell, till, towards the close of the Exhibition, there were not more than 350, the rest having given out.

The lamps last supplied, making up the 600, were machine made by Wright and Mackie, the carbons being prepared to the orders of Messrs. Ferranti, Thompson, and Ince, for their Exhibit. Whatever might be the cause, they did not compare favourably with the Swan lamps, used in the other part of this installation, most of which lasted the whole course of the Exhibition. But it is only fair to say that the patents of Messrs. Wright and Mackie are for the glass-blowing work of incandescent lamps, and that the manufacture of carbon filaments is not their speciality.

There was, over the salt-water tanks, a considerable outlay on the Swan hook-holders used for the lamps; this arose from the oxydisation of the hooks, by the action of the salt-water spray and the heat of the lamps upon them. In all, 450 holders were replaced.

It was found that a coating of paraffin reduced but did not entirely prevent the oxydisation. The use of paraffin for this purpose was, however, adopted at such a late date in the Exhibition as to be of little value.

The results of trials made of the last-mentioned machine at the exhibitors' factory, Appold Street, Finsbury, as published, give it a high place in point of efficiency, and I regret very much that I was unable to substantiate them by the larger and more thorough test which four months' run of lighting at the Exhibition would have given.

The Ferranti 300-lighter, before mentioned, having been only sent us temporarily (till the arrival of the 1000-lighter), was not tested, but this machine has been well tried at the Aquarium, at the Oldham and Huddersfield Exhibitions, and elsewhere.

A.—INCANDESCENCE LIGHTING.

I. BY ALTERNATING CURRENTS.

3. *Siemens-Swan.*

This installation was fitted up by the Swan United Electric Light Company, in the Royal Pavilion, furnished by Messrs. Gillow. The fittings to which the lamps were attached were by Messrs. Perry, of Bond Street, and, being of very special design, to suit the ornamentation of the rooms to be lighted, were not constructed for electric lighting. They were, however, very admirably adjusted for that purpose by Messrs. Perry, and were as follows:—

ENTRANCE—

A wrought openwork bronze lamp, copied from those in St. Mark's, Venice, fitted with 4 *electric lamps.*

HALL—

A wrought-iron chandelier for 12 *lights, and* 2 *brackets to correspond, for* 3 *lights, of Italian design,* *ornamented with foliage, roses, tulips, &c., in hammered work.*

In each bow 2 *small chandeliers for* 6 *lights each, of similar work.*

The above had the lights placed within amber-coloured globes.

Near the fire-place a tall candelabrum, about 7 *feet high, in wrought-iron, designed in the style of Huntingdon Shaw, of Nottingham, whose celebrated iron gates for Hampton Court Palace are now at the South Kensington Museum. The above had* 6 *lamps under a large umbrella-shaped shade.*

DINING ROOM—

Four bronze pedestals 4 *feet high, after Donatello, from the Church of San Antonio, Padua; with tripod bases, and the various members of the shafts ornamented with figures. The whole surmounted with cut-glass vases carrying* 6 *lamps each.*

Four inverted shades decorated with repoussé brass covers, and carrying 8 *lamps each, for lighting up the ceiling.*

DRAWING ROOM—

A chandelier in the centre with 12 *electric lights in the richest cut-glass in the style of the "Adams" period. A pair of* 4*-light girandoles on the mantelpiece, with Wedgwood bases and richly chased, and gilt mountings, and with cut-glass to match the chandelier.*

(*The above were reproduced from the old drawing-books of* 1790, *belonging to the firm, which have fortunately been preserved.*)

SMALL ROOM ADJOINING—

Two mirrors, with old silvered frames in the

Renaissance style, carrying 2 electric lights each, in opalescent globes.

STUDY—

Two mirrors in the Venetian style, with massive brass frames ornamented with lions, and carrying 3 electric lights each, in opalescent globes.

KITCHEN AND OFFICES—

One 5-light pendant.
One 3-light do.
Two brass 1-light brackets.
Two wrought-iron do.

Each electrolier, &c., was furnished with a switch, by which it could be turned on and off, and the chiaroscuro of the rooms changed.

The electric portion of the installation was of slight interest, the main feature being the use of Swan 82 volts 20 c.p. lamps. Of these there were maintained 185 by a Siemens W 1 alternating machine, of the ordinary well-known type.

This machine and its attendant exciter, running respectively at 720 and 1200 revolutions, gave 180 and 22 ampères, and ran satisfactorily the whole term of the Exhibition without any stoppage or default.

The lighting of the Royal Pavilion Dining-room, with its adjacent alcove and smoking-divan, demonstrated to a slight extent the possibilities of decorative illumination by electric light. The former was lighted by four standards of eight lights each, and four pendants, also of eight lights each, at intersections of the panelled ceiling. These could be used independently, so that very charming changes of lighting of the room were attainable; the lights in all cases were well subdued by ground-glass. The alcove was lit by a line of lamps above the cornice, hidden from direct view, but the light from which, reflected from the elaborate and decorated ceiling, caused a pleasant illumination of the lounges and their occupants.

The approximate cost of this installation is shown in Appendix B. The actual H.-P. was not registered, but the performance of Messrs. Siemens' W 1 machine is so well known, that this was unnecessary.

A.—INCANDESCENCE LIGHTING.

II. BY CONTINUOUS CURRENTS.

1. *Gramme-Mackie.*

This was a small installation put up by Mr. S. J. Mackie, of the Electric Contract Agency Company, being chiefly an exhibition of new machine-blown incandescence lamps prepared by Messrs. Wright and Mackie (with filaments arranged in a spiral). The installation was characterised by the softness of the lighting produced by special opalescent globes, and the lamps, nominally 20 c.p., were run during the whole time at 26 c.p. light. These lamps withstood great variations of current without damage, but the power absorbed was rather more than that ordinarily taken by the Swan lamps. The value of the additional power was given out in proportionately increased luminosity. Some of these carbon filaments have shown great endurance.* The Fisherman's Home and Allen's Hut were lit up by this system; the former, used as a Jury Room, was very plentifully supplied, by Mr. Mackie, with suitable fittings of a nautical character, and with special brackets, lent by R. H. Hughes, of Hatton Garden.

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* 1780 hours.

The machine from which the current was supplied was an ordinary E Gramme machine, wound for "incandescence lighting."

The installation worked quite satisfactorily throughout the Exhibition, but, as above stated, had not a very severe test.

A.—INCANDESCENCE LIGHTING.

II. BY CONTINUOUS CURRENTS.

2. *Francklin-Bürgin-Swan.*

The Electric Light Supply Company arranged this installation for the lighting of the Literary Superintendent's room, &c., and for this purpose used one of their modified Bürgin machines and Swan lamps, the lamps being arranged in four parallels of ten each. This exposition of compound-parallel was very successful and gave no trouble, very few lamps having to be replaced during the Exhibition. The lamps were arranged singly at intervals round the cornice and principals of the roof, and gave an even, soft light, quite suited to the requirements of the occupants of the rooms.

A.—INCANDESCENCE LIGHTING.

II. BY CONTINUOUS CURRENTS.

3. *Elphinstone-Vincent and Woodhouse and Rawson.*

This was a joint installation carried out by the above firms. The position assigned to the exhibit was the Entrance Vestibule and Picture Gallery.

The Vestibule was lit by 215 lights, arranged, as in the Main Gallery beyond, on the points of the girders sustaining the roof; but in this case, grouped in pairs and triplets alternately, so as to give a sort of checkered effect of lighting, which was very effective.

The Picture Gallery was lit by 120 lamps, in three cut-glass electroliers, exhibited by Messrs. Osler and Co., of 100, Oxford Street, the centre one carrying 90, and each of the others 15, lights.

Besides this, in the Vestibule, the cut-glass exhibit by Messrs. Osler had many lamps disposed here and there, not only enhancing their exhibit but giving a pretty effect in the lighting.

Woodhouse and Rawson Lamps.

The lamps used were W. and R.; 45 volt. 20 c.p. lamps. There were 350 in all.

Entrance vestibule	215	
Electroliers	120	
Messrs. Osler's Exhibit	15	
		350

They were arranged 2 in series. Their lighting power, although not tested, was very satisfactory, and their duration also, although from several causes—short circuiting on one or two occasions, and over-speeding of the dynamo—they were severely tested.

The returns of breakages, &c., during the Exhibition were as under:—

Accidentally		42
Electrically	July August September October	18
	Total	60
Total	Accident	42
	Electrical	18
or an average of 17 per cent.	Total	60

The hours run by the installation were .. 476

Elphinstone-Vincent Dynamo.

The dynamo which served this installation was supplied by Messrs. Elphinstone and Vincent, being a continuous-current machine of their well-known type, giving an ampère current of nearly 200, and E. M. F. 92, at a speed of 950 revolutions.

This machine ran fairly well during the Exhibition, but showed considerable delicacy (in common with most continuous-current machines of large quantity) at the commutators, and had a tendency to lose E. M. F. by short circuiting on the commutator itself, through deposit of melted copper from the brushes. If, however, very carefully watched and attended to, this may be much reduced; but it constitutes a practical drawback to the general use of the machine, especially where long-continued running is required. It was found that 4½ to 5 hours' steady running always reduced the E. M. F. of the machine from the above causes, at least 8 to 10 per cent.

The only tests of the machine were taken after the close of the Exhibition through a constant resistance and through a variable resistance. The falling off of E. M. F. was clearly shown to be due to the above mentioned causes.

The only causes of break-down during the Exhibition were those referable to the commutator, and were not very numerous.

The area of commutator, per ampère of current, as shown in Appendix D at end of this Report, is less than half that of all other machines, and quite explains the failure of the commutator as noticed.

Mechanically the machine labours, in consequence of its design, under a great disadvantage as to facility of lubrication on the running axis.

It is further inconvenient to repair small damages to the armature-coils, &c., or even to examine them.

The machine at the Exhibition had not full justice done to it, as the leads supplied by Messrs. Woodhouse and Rawson for their installation were not of sufficient capacity for the distance at which the installation was from the machine (900 feet); and the speed at which the dynamo was arranged to run did not give the extra E. M. F. sufficient to overcome the extra resistance in them; so that nearly 7 electrical H.-P. out of 38 (or 18½ per cent.) of the work done in external circuit was absorbed by the leads, which was not only uneconomical but detrimental to the general results.

A.—INCANDESCENCE LIGHTING.

II. By Continuous Currents.

4. *Gülcher-Crookes.*

This installation was undertaken by the Gülcher Electric Company, and consisted of a battery of No. 5 Gülcher dynamos, working 602 Crookes 16 c.p. incandescence lamps, in the Western Gallery and China sections.

The disposition of the lamps was based upon that already adopted by Messrs. Siemens in the Deep-Sea Fisheries Gallery, but modified—1, by the suspension of the lamps some three feet from the points of the girders, instead of direct attachment to them; 2, by the introduction of coloured shades above the lamps, which it was expected would have given a parti-coloured effect to the illumination, but which ultimately rather increased than otherwise the very disappointing effect of this exhibition.

This is the more to be regretted, because this company came forward so very cordially and liberally to assist in carrying out the programme fixed upon for the lighting of the Exhibition.

Dynamo.

The dynamos used were the ordinary type dynamo of low tension and large quantity, specially designed to yield "safe" currents. This very advantage, from an economic sense, proved the cause of failure in the present instance, as the distance at which the installation was put up was so great (over 300 yds.), despite the fact that 32 $\frac{9}{16}$ B. W. G. leads were put up to carry the current, that it quite ruined the success of the lighting, over 22 H.-P. El. being absorbed in merely conveying the current from the dynamos to the Gallery to be lit.

This absorption of power was so serious that the pulleys had to be changed to increase the speed of the machines, and get increased E. M. F. But this only burnt up the machines, and it was decided ultimately to decrease the speed, bring back the E. M. F. to the normal of 65 to 70 volts, and in order to get equivalent of light to reduce the lamps from 65 to 45 volts. This, however, was so uneconomic, that the meagreness of light was more evident, and the H.-P. required being greatly in *excess* of that asked for by the Company, or provided for them, it was impossible to improve matters.

One cannot but think in reviewing this installation that the whole breakdown lay in the arrangement of leads—the estimated El. H.-P. for 602 Crookes 16 c.p. lamps, at 1 ampère and 65 volts to a lamp, is 52 El. H.-P., which was about all the dynamos gave at their terminals, whereas over 20 El. H.-P., or nearly 40 per cent. of the electrical energy given off by the machines, was absorbed in leads. When the *low* electrical efficiency of the dynamo itself (less than 70 per cent.) is taken into consideration, it is not difficult to perceive the cause of the very inefficient justice done to the Crookes lamps.

Of the latter, no possible statistics could be rendered, as the first batch of 65 volt lamps were replaced by 45 volt lamps made to suit the occasion, and these from no point of view could be looked upon as doing justice to the Crookes filament and lamp, which is better designed for a high E. M. F. and smaller current.

Beyond the above-mentioned causes of failure there was also the fact that the court chosen for illumination was perhaps the least favourable in the whole Exhibition for the purpose, because the decorative effects introduced by the exhibitors from China, Japan, and India, were of a deep colour, and absorbed light rather than reflected it; while the Joss-houses and canopies prevented the light in the roof from being of value on the floor area.

It is therefore very evident that, from every point of view, the Exhibition of Crookes lamps by this Company was not one of a practical character on which to base any opinions of the lamp, and that the installation at large suffered very much from insufficient care in the consideration of the class of machine to provide, the speeds at which the machines should be driven, and the size of the conductors requisite for the purposes of the Exhibition.

B.—ARC LIGHTING.

1. BY ALTERNATING CURRENTS.

1. *Jablochkoff System.*

The installation of the Jablochkoff Electric Light Company, by which the Courts appropriated to part of Canada and the United States, Newfoundland, Denmark, and Belgium were lighted, was a fair exposition of the features of the Jablochkoff system.

This Company provided a battery of 4 alternating current Jablochkoff Gramme machines, each capable of driving 4 circuits of 5 lamps each, 20 in all, and each circuit having an E. M. F. of 250 volts and a current of 7½ ampères. From the 4 machines, therefore, 16 circuits were taken in a tube underground to the switch board in the centre of their installation; out of these, 14 circuits were continually in use, 2 being kept in reserve in case of a failure.

The dynamos were grouped as shown on the Plan, and were driven by a portable engine set apart for this system.

The lamps were arranged singly, and were suspended by rods in pairs at intervals from the girders. There were 36 lamps lighting Newfoundland, Denmark and Netherlands, 12 in Canada and the United States, and 12 in Belgium. The candle-power of each of these lamps was about 330, being the usual value of the size of lamp employed.

In the Central Avenue out of doors were fixed 4 posts, two of which carried a double-candle lamp, and two a 3-candle lamp. This made up in all 70 pairs of candles burning at once, leaving, as before stated, 2 circuits of 5 each in reserve.

The working of the installation, so far as the dynamos were concerned, was satisfactory, very slight mechanical derangements being the only matters reported. But the running of the lamps was hardly satisfactory, and this was dependent on the inherent faults of the system. Up to the present, although many attempts have been made, no reliable automatic arrangements for the switching of the circuits from one set of candles to another, in case of interruption of circuit by breaking of a candle or burning out, is available; in consequence of which, an attendant had to be ever at the switch board and on the watch, to turn over the circuits when the candles were burnt out, or to light up circuits afresh which had been broken by failure of carbons, &c.

This drawback was severely felt during the Exhibition, and hardly an evening passed without one of the fourteen circuits being reported as having failed.

The cost of the carbons used in this installation relatively to the amount of light given, viz., 1·55*d.* per hour per lamp, is excessive, and is again dependent upon the fault of the system, to which allusion has already been made, and upon the fact, that a pair of candles once lit, if only for five minutes, have to be retipped with carbon paste in order to light them again at all. Whenever a circuit fails, therefore, five candles have to be wasted. The retipping was found to be troublesome and not always effective; and consequently many refuse candles and unburnt ends were left, sufficiently accounting for the high figure above quoted. Coincident with this waste is the non-automatic change of candles, necessitating an attendant who puts over the circuit, without reference to the state of the candles, but at a fixed time, every 2½ hours (that being the computed time for which a candle lasts), so that should the candles be burning slowly, there is a longer end left than necessary, and as they very often burn very unequally, the attendant switches over a quarter of an hour too soon so as to save the extinction of the light in the circuit. Moreover, as the candles are made to last 2½ hours, it is obvious that for short daily hours of running, such as prevailed at the Exhibition, and which may range from three to six hours' burning, there must be a great amount of waste on account of such want of power to re-light a candle once burnt, without retipping.

These two drawbacks were so patent during the Exhibition, especially that of *re-tipping*, that I devoted some attention to the latter subject, and eventually achieved a result of considerable economic value which, had I been using it during the continuance of the Exhibition, would have economised at least £40 upon the item of carbons for this installation. It was briefly as follows: When the lamps were retrimmed, there usually remained from overnight, upon four hours' running (a fair average of our work), one burnt out candle and one candle with one hour to run, with perhaps a spare candle burnt a short time, but which through failure of its circuit was a wastrel. In the ordinary course these *three candles would all have to be taken out and replaced*, leaving one hour on one candle, and an unknown quantity upon the other, and one burnt out end *to be thrown away*. Instead of this, I obtained from Mr. Varley some of his ¼-inch "flexible carbon," and cutting it into suitable lengths of 2 inches each, trimmed the unfinished candles "in situ" by pressing the flexible carbon on to the sharp burnt ends of the carbons, where it remained as a conductor, but one of such high resistance that upon the current (7½ ampères) passing through it it gradually rose to a red heat, and as it fell to pieces through "combustion," the arc struck, and the candle lit.

In consequence of the fact that I only hit upon this idea toward the close of the Exhibition, and that Mr. Varley could not supply me with much of his "flexible carbon," I could not substantiate by practical working that which my trials proved to be a great economy.

B.—ARC LIGHTING.

1. BY ALTERNATING CURRENTS.

(2) *Gérard-Gérard, Siemens-Gérard.*

This installation, erected by the Gérard Electric Light Company, lit the two Courts appropriated to exhibits from Spain and Russia.

The Spanish Court was supplied with seven Gérard arc lamps of about 1200 c.p. each, working in series, from a Siemens' alternating machine W 2 type; the Russian Court with eight Gérard lamps upon derived circuits, from a Gérard alternating machine of a disc type, but with revolving exciting magnets and fixed armature.

The lamps after being once balanced worked very equally during the Exhibition, and gave satisfaction.

The only failure which occurred arose from the Siemens machine, as delivered to the Exhibition, being in a very bad state of repair, but when it had been sent to Messrs. Siemens' works to be overhauled, it gave no further trouble.

The Gérard machine also ran without any trouble, but in comparison with the Siemens disc machine at its side, did not impress one with the idea of economic efficiency in power applied.

As no tests were possible of H.-P. absorbed, the relative economy was not substantiated.

The carbons used in the installation were 12 mm. Siemens carbons, and carried a 17 ampère current. Their average cost per hour was 1·75*d.* per hour; which in common with all *single* arc lamps is higher than it should be for proper economy.

B.—ARC LIGHTING.

II. By Continuous Currents.

(*a*) OF LOW TENSION.

1. *Gülcher-Gülcher.*

The sections of Machinery in Motion and the Electric Light Shed were lit by 23 arc lamps of the small Gülcher type—about 300 c.p. actual, driven by a No. 4 Gülcher machine, forming part of the battery of dynamos, installed by this Company.

The lamps were of two types—that designed for street lighting, and that for workshops—their working arrangements were similar. The current taken by each lamp was 6½ ampères with E. M. F. 70. The lamps were arranged in parallel arc. After they were properly regulated, which from different causes required some little time and management, these lamps gave fairly good results, but they never attained proper steadiness. This was ascribed by the electrician of the company to the changes of speed of the engine; but I do not think it is entirely attributable to that, but to the system itself, which at all times is a difficult one to regulate.

This is sufficiently proved by the large number of lamps which were burnt up before the installation got fairly into working order. Short circuitings occurred frequently, and the dynamo was much tried at the commutator, and in several instances the armature coils burnt.

The carbons used were Siemens' Berlin Carbon 10 mm., top and bottom. But with the single lamps which were supplied, and the hours we ran nightly, there was considerable waste, and the running cost of carbons per lamp per hour was 1·87*d.*, which is very much higher than, according to the Company's estimate, should be the case.

From the experiences of the Exhibition, this system, although it is claimed to be a *safe one*, does not apparently bear out the idea of an economical one, in the first cost of energy supplied, in the first cost of plant requisite or its cost of maintenance, in the consumption of carbons per unit of energy, or in the amount of light obtained in the arc.

B.—ARC LIGHTING.

II. BY CONTINUOUS CURRENTS.

(*a*) OF LOW TENSION.

Siemens-Siemens.

The Conservatory was appropriated to the above system, in which 4 large 5000 c.p. Siemens' lamps were arranged in *parallel arc.* They burnt most satisfactorily throughout the Exhibition. Each lamp was designed to carry 35 ampères, but in consequence of overspeeding the dynamo (S.D.O.) supplying them, they carried over 42 ampères each, giving very fine results, and burning with perfect steadiness. Their powerful yet soft light lit up the Conservatory as if by day.

The machine whence the current for them was derived was a continuous shunt-wound machine, and gave, till the pulleys were altered to reduce speed, 169 ampères at the terminals. This immense current required constant attention at the brushes, and in two cases (once at a very critical time when the Conservatory was crowded with people expecting the Princess of Wales's arrival on the occasion of the Berlin fête) caused them to melt and thus put out the lights. After this it was found advisable to change the brushes occasionally so as to prevent their overheating. After the speed of the machine was changed from 650 revs. to 610 revs. no further trouble was experienced. The total lamp hours run at this installation were 1256, the cost of carbons per hour upon that time was 3·88*d.* The carbons used were Siemens' Best Quality cored Carbons, top 18 mm., bottom 15 mm.

B.—ARC LIGHTING.

2. BY CONTINUOUS CURRENTS.

(*a*) OF LOW TENSION.

3. *Gramme Brockie.*

This single light was placed in the Third Class Refreshment Room and Bar, and worked quite satisfactorily, without trouble.

The machine and lamp were of the ordinary Gramme and Brockie type, so well known as successfully lighting Cannon Street Station and elsewhere.

The dynamo gave a current of 22 ampères with E. M. F. about 82; the carbons used were 18 mm., top and bottom, yielding a c.p. of nearly 3000.

B.—ARC LIGHTING.

2. BY CONTINUOUS CURRENTS.

(*b*) MEDIUM TENSION.

1. *Francklin-Bürgin-Jarman.*

In the shed set apart for the Lifeboats, 6 lamps, Jarman patent, driven by the current from a dynamo of the Francklin-Bürgin modified type, were exhibited by the Electric Light Supply Company.

The lamps, however, when sent had not been properly balanced, and for a very long time the court could not be opened to the public on account of their unreliable character.

They never attained any great success, the feed being apparently not sufficiently *elastic* in its action to prevent very heavy strains being occasionally put upon the dynamo supplying them. The carbons used were 14 mm., and the current 18 ampères, the lamps being worked in series. The records concerning this installation are very interrupted, and the cost comes out unfavourably in consequence.

B.—ARC LIGHTING.

II. BY CONTINUOUS CURRENTS.

(*b*) OF MEDIUM TENSION.

2. *Ball's Unipolar System.*

This small installation of seven lamps and one Ball's C. machine was of great interest on account of the novelty of design of the machine with two armatures, each only excited by a single pole—(N.B. this is how it is explained to me, but I think there is reason to doubt the fact)—and further, by its very great apparent efficiency. The portions lit by the seven lamps were the Fish Market, with four lamps, and the Pavilion Corridor, with three lamps, all working in series, and with a current of 13 ampères and E. M. F., 240 volts, burning a pair of 12 mm. carbons, the c.p. being estimated at 1000 to 1100 each.

The machine ran freely from the time of its arrival to the close of the Exhibition, and except through the breaking of a driving belt, which was too light, never stopped or gave any trouble. The lamps also after being adjusted gave very satisfactory and steady light.

As, however, the installation was not completed till Sept. 10th, the running cannot be accurately compared with that of other machines which had been present throughout the Exhibition.

The cost of carbons per hour is 2·7*d.*, which is very low, considering the high value of light given in the lamp.

This system, from what was shown, may lay claim to equality with any present at the Exhibition for economy and efficiency, and will no doubt soon attain in England the high place in public estimation which has already apparently been accorded to it in the United States.

B.—ARC LIGHTING.

II. By Continuous Currents.

(*b*) MEDIUM TENSION.

3. *Gramme Brockie.*

The two Courts devoted to the Swedish and Norwegian Exhibits were lit by 12 "Brockie" lamps driven by Gramme-dynamos. The installation was the exhibit of the British Electric Light Company, and was most satisfactory, both machines and lamps running the whole course of the Exhibition without any serious interruption of the lighting of the courts.

The lamps exhibited were those of Mr. Bróckie's improved patents and were exceptionally steady in their light. The current used was 16 ampères, with E. M. F. 250 volts; the carbons used were 13 mm. top and bottom; and the running cost per hour throughout the Exhibition was 2·02*d.* The estimated c.p. from 1900 to 2100 per lamp gave a very beautiful light throughout the courts. Five lamps were suspended centrally from the girders at equal distances in the 2 outside bays, and 2 were hung in the central bay forming the court.

The dynamos used were E. Grammes, running at 900 revs. per minute, excited by an A. Gramme at 1150 revs., giving an ampère current of 22 and E. M. F. about 90.

The lamps were arranged in tension on two circuits, one carrying 7 and the other 8 lamps. The extra lamp on the latter circuit was fixed on a post and lit the Steam Dredger exhibited by Messrs. Priestman.

B.—ARC LIGHTING.

II. BY CONTINUOUS CURRENTS.

(*b.*) 4. (*c*) LEVER.

Gramme-Lever. Bürgin-Lever.

The installation of arc lamps in the Dining Rooms by Mr. Charles Lever, which, from its conspicuous position, ought to have been the most perfect in the Exhibition, was the least successful of all the arc displays.

The number of lamps furnished by Mr. Lever was 28. These were arranged, 8 in the first class, 6 in the second class, and 4 in the Cheap Fish Dining Rooms, 3 in the Kitchens, 3 in the Lecture Theatre, and 4 in the Picture Gallery adjacent.

There were four machines used to maintain these lights, viz., 2 Bürgins, feeding 6 lamps each, and 2 Grammes, feeding 8 lamps each, the E. M. F. of the Gramme machines being 250 with a current of 12 ampères, and that of the Bürgins 250 with a current of 22 ampères. The Grammes were shunt-wound, the Bürgins ordinary type. In both cases, especially in that of the Bürgins, the machines were run very much above their normal speed, which fact contributed considerably to the want of success in this lighting. Moreover, Mr. Lever used a single return circuit for all four machines, which is at all times a matter of doubtful advisability where two separate E M F's are in play.

The lamps themselves being cheap in construction, designed for workshop lighting, have a very simple mechanical action, but one which is liable to severely try the dynamos used on account of its action.

The lamp hours run by this installation were 7870, at a cost per hour of 2·42*d.* The Carbons used were Bolton 11 mm.

B.—ARC LIGHTING.

II. BY CONTINUOUS CURRENT.

(*b.*) 5. *Gramme-Lea.*

Mr. S. J. Mackie, the representative of the Electrical Power and Light Contract Agency, not only contributed to incandescent lighting, but illuminated the Courts devoted to Canada and the United States with 15 arc lamps (Lea Patent) of a very strong illuminating value.

These 15 lamps were arranged upon 3 circuits of 5 lamps each, being driven by 3 E Grammes (ordinary type), excited by an A Gramme. The current in each circuit was 21 ampères, and the E. M. F. about 185; the estimated c.p. of the lamps was 2400.

The only new feature about this installation was the construction of the lamps (Lea Patent). These can be spoken of with praise, having given great satisfaction from the very beginning of the Exhibition.

In fact, the Commissioners were indebted to them for the facilities which were enjoyed for the arrangement of the Courts at night, before the Exhibition opened.

The only failures of this installation were the burning of shunts in one or two lamps in the course of the Exhibition.

The lamp hours of this installation were 4520, at a cost of 3·25*d.* per hour. Carbons used were 12 mm. top, and 20 mm. bottom.

B.—ARC LIGHTING.

II. By Continuous Currents.

(*b.*) 6. *Bürgin-Willard.*

A small installation in the Western Quadrant by the above exhibitor was in action the greater part of the Exhibition. There were 6 lamps on the Willard Patent driven by 2 Bürgin machines. The lamps, however, did not go very well, and could not claim much attention in respect of their practical value.

B.—ARC LIGHTING.

II. By Continuous Currents.

(*c.*) *Schückert-Pilsen.*

The Western Gallery was lighted by 2 series of 13 of the well-known "Pilsen" lamps running upon Schückert machines of an improved construction. The E. M. F. of the circuits was 620 volts, with a current of 7 ampères. This installation was put up by the "Pilsen-Joel" Electric Light Company, but as it was only brought into action quite late in the course of the Exhibition, the records of running are hardly comparable with those of other arc systems.

During the time that the machines and lamps were in action they gave every satisfaction, and required very little attention. The estimated c.p. of the lamps was about 1000.

The total lamp hours run were 6208, at a cost of 1·3*d.* per hour. The Carbons used were 10 mm.

B.—ARC LIGHTING.

II. CONTINUOUS CURRENTS.

(*c*) HIGH TENSION.

2. *Hochhausen System.*

It may fairly be asserted that, in point of novelty and conspicuous position, this system, exhibited by the owner of the patents in this country, Mr. Henry Edmunds, was the most interesting.

There were 3 Hochhausen machines of different sizes exhibited, all designed for arc lighting, the larger one working 25 arc lamps (nom. 2000 c.p.), in series, in the Promenade; the smaller ones, respectively, 15 arc lamps (nom. 2000 c.p.) in series, in the Eastern Corridor, and 6 large arc lamps, also in series (nom. 5000 c.p.), at the top of the mast in the upper gardens.

The E. M. F. of the large machine was 1250 with current of 10 ampères; of the smaller ones, E. M. F. 750 each; currents, 10 and 23 ampères.

The main feature of this machine is the regulator by which unequal E. M. F. is obviated despite change of speed. This was very well tested during the Exhibition in consequence of the irregularity of speed of the engine driving these machines, and the result was very satisfactory, the lamps remaining of an equal brilliancy and steadiness throughout.

The 2000 c.p. lamps exhibited were double lamps to burn 16 hours, burning 10 mm. "Excelsior" Carbons. The working cost upon 12,307 lamp hours during the Exhibition was ·87*d.* per hour.

The 5000 c.p. lamps burnt 16 mm. "Siemens'" Carbons at a cost of about 2·15*d.* per hour.

The Six Lamps, at a height of 110 feet at the top of the mast in the Upper Grounds, not only gave a pleasant moonlit effect of illumination to the grounds, but were a conspicuous feature of the Exhibition at night, being visible from all parts of the suburbs of London, notably, Sydenham and Richmond Park.

GENERAL REMARKS.

Having completed the detailed report of the individual systems of lighting at the Exhibition, it may be well to summarise in a brief manner the general phases of the Exhibition under the following heads:—

I.—*Causes of Break-down.*

These break-downs were due to mechanical and electrical failures.

Of the mechanical failures, as already explained, a certain amount of irregularity was the outcome of rather hurried preparations in the designing and arrangements of the engine-power, and a further portion was on account of water getting into the wheel races of the large engines, Nos. 5 and 6, on one or two occasions, at the commencement of the Exhibition, to such an extent that the engines had to be stopped to prevent the belts coming off. To overcome the latter it was found necessary to put wrought-iron shoes into the wheel races, and after this all difficulties of that character disappeared.

The electrical failures might be classified under the heads of "Failure of Dynamos," and "Failure of Lamps."

The dynamos which suffered most were the Gülcher, the Lever, and the Franklin-Bürgin. In each of these cases the failures of the machines were not simply that of the commutator, but arose through the burning up of the

Armature Coils on account of short circuiting; beyond this, all the continuous current machines were liable to failure in the commutator, whereas the *alternating current machines* in *no case* gave any difficulty.

With regard to the lamps, the shunt coils of the Lea, Brockie, Jarman, and Willard lamps were the parts that suffered most; and in the case of the Gülcher arc lamps the rheostats, through overstress of current, were burnt up, and had to be replaced.

In extension of these remarks I subjoin a series of appendices, as follows:—

Appendix A gives a summary of the expenditure by the Commissioners on account of the Electric Lighting Department of the Exhibition. This expenditure reached the amount of £9967, &c. In analysing this amount, however, it is seen that a sum of £3778 was expended for the mere purposes of the shed, foundations, and permanent work necessary for the installation at large. The other items of the amount show the cost of labour necessary for the erection of the different installations, paid for by the Commissioners; the motive power paid to Messrs. Paxman & Co. on account of rental of machinery for the purposes of the Exhibition; and, finally, the maintenance charges, which include labour paid for the supervision of the running, machinery, and installations, and the cost of carbons, stores, &c., incidental upon the running, for the four or five months during which the Exhibition was lighted. It is very clear that the item, £3778, should not be charged entirely to this Exhibition if a fair estimate is to be made. I have, therefore, charged only 25 per cent. to the Exhibition, giving a credit of 75 per cent. as on available material for future use. Thus reduced, the current expenses of the Exhibition amount to £7133 18*s.* 11*d.*, and I think it may be unhesitatingly asserted that the Exhibition could not by any means have been lighted by gas (at the standard price) at a similar figure, and certainly not with the same small fire-risk, and complete efficiency.

Appendix B gives details as to the approximate cost of the installations of the several systems. I have resolved them into two classes, viz., arc and incandescence installations, and for the purposes of comparison I have worked out the approximate cost, at per lamp, of each installation. I do not pretend that these figures are absolute, but I think they may be taken as a very fair guide to the relative costs, especially when the question of relative candle-power is taken into account.

Appendix C shows the relative cost of the arc lighting in the several systems present on the mere item of carbons used alone. This again must be taken as only approximate, although indicatory of the value of the different systems in this respect. The item of carbons is one which is affected, in the first place, by the price paid for the carbons (which is very variable), and which should depend, to a great extent, upon the character of current used, and to what extent the lamp requires, or rather the exhibitor desires, to have the most perfect effect of lighting.

It will be seen at a glance that the cheapest systems are those of a *high tension*, such as the Unipolar, the Hochhausen, and the Pilsen.

A second advantage to be carefully taken into account, especially where, as in the case of the Exhibition, the hours of running are relatively short, was the fact that the Hochhausen, whose unit of costs stands lower than any other, used *double lamps*, by which means the waste of carbons was reduced to a minimum. In the other cases the waste quite equalled 25 per cent., in consequence of the inability to use carbons of certain short lengths advantageously. Had the running continued longer, these might, at a later date, have been used to advantage; as it was they remained as waste in stock.

The last appendix, D, is one which I have ventured to introduce as bearing, to a great extent, upon the practical features of electric lighting.

I do not consider that it is within the scope of this report to analyse at full length all the figures present in this Table, but I feel that in glancing through it practical readers will grasp a considerable amount of information which, I venture to believe, has never been so concisely put before them till now.

The main points which may be noticed are as follows: (1.) The relative cube area occupied by the machines. (2.) The energy given out by the machines. (3.) The cost, as compared with the energy given out, at a unit of Watt power. (4.) The value from a point of energy of the copper conductors in the machines, whether in the field magnets or in the armatures.

Besides this for the continuous machines, the question of the Ampère area in the commutators is one which is worth notice.

Many other questions suggest themselves, which I have not had time to touch upon, but I feel that these Appendices form a fit adjunct to the reports in detail of the different systems which precede them.

Finally, I believe that the Great International Fisheries Exhibition has been by far the largest attempt at practical lighting by Electricity ever carried out; and although, as I before said, I have much regretted that the Society of Telegraphic Engineers, by falling in with the desires of the Commissioners, did not fully supplement the practical experience of the running of the Exhibition, here set forth, I feel that the records, thus compiled, must always remain of much value to those interested in this grand and marvellous economic development.

WILLIAM D. GOOCH,
Electrical Engineer in charge.

APPENDIX A

STATEMENT OF TOTAL EXPENDITURE IN ELECTRIC LIGHTING DEPARTMENT TO MARCH 31, 1884.

	£	*s.*	*d.*
Wages paid for construction (*a*)	1436	1	6
Materials, apparatus purchased and hired (*b*) .	2341	19	11
Engine hire (*c*)	3947	13	8
Salaries and wages (working) (*d*) . . .	1266	7	11
Carbons, oils, sundries, &c. (*e*) . . .	975	12	4
	£9967	15	4

	£ *s.* *d.*		
Maintenance (*c*) .	3947 13 8		
„ (*d*) .	1266 7 11		
„ (*e*) .	975 12 4		
		6189 13 11	
Add 25 % of £3778 1*s.* 5*d.* ..		944 5 0	
			7133 18 11
Installation costs (*a*)	1436 1 6		
Property capital account (*b*)	2341 19 11		
		3778 1 5	
25 % on £3778 1*s.* 5*d.** ..		944 5 0	
			2833 16 5
			£9967 15 4

Total cost chargeable to this Exhibition £7133 18*s.* 11*d.*

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* This is allowing 4 years' purchase on the plant and building.

APPENDIX B.

MEMO.—The following estimates are not intended to convey any very *comparative* value of one system with any other, but rather as a record of actual cost of the systems as installed at the Exhibition.

In all cases, if comparisons are to be made, the number and candle-power of the lamps is to be taken into account as well as the distance the installation was from the machinery working it.

No. 1.—INCANDESCENCE LIGHTING.

ESTIMATED COST OF INSTALLATION IN THE PRINCE OF WALES'S PAVILION.

Exhibitor.—"Swan" United Electric Light Company.

	£	s.	d.
Siemens Machine, W 3, D 7 Nos. on Plan, 17, 18	300	0	0
Fittings lent by Messrs. Perry			
Globes " " "			
Lanterns " " "			
Inc. Lamps 187 (82 volts) at 5*s.* " Holders 187 " " at 1*s.*	56	2	0
Switches Cut-outs	2	10	0
Leads Mains Services	62	0	0
Sundries			
Cost of labour Installation	22	0	0
Total	£442	12	0

or per light—187 at £2 6*s.* 3*d.* each.

The fittings were of an expensive character, and are not included. The installation was about 200 yards distant from the dynamos.

No. 2.—INCANDESCENCE LIGHTING.

ESTIMATED COST OF INSTALLATION IN ENTRANCE VESTIBULE AND FINE ARTS GALLERY.

Exhibitors.—Messrs. Elphinstone and Vincent; Messrs. Woodhouse and Rawson.

	£	s.	d.
Machine 19, on plan	400	0	0
Fittings, lent by Messrs. Osler			
Inc. Lamps, W. S. R., 350 at 4*s.*	70	0	0
,, holders, 350 at 1*s.*	17	10	0
Switches Cut-outs	2	10	0
Leads (lent by Henley's Tel. Wks. Co.)	194	0	0
Mains Services say	10	0	0
Cost of labour Installation	52	10	0
Total	£746	10	0

Or per light—350 at £2 2*s.* 8*d.*

The fittings of cut glass, furnished by Messrs. Osler, are not included. The distance of the installation averaged 350 yards from the dynamos.

No. 3.—INCANDESCENCE LIGHTING.

ESTIMATED COST OF INSTALLATION IN DEEP SEA FISHERIES.

Exhibitors.—Messrs. Siemens Brothers & Co.

	£	s.	d.
Machine 22 ,, 23 V. List	550	0	0
,, 24 ,, 25	550	0	0
Inc. Lamps, 1080 at 5*s.*	270	0	0
,, Holders, 1080 at 1*s.*	54	0	0
Cut-outs Leads Mains Cost of Installation	897	0	0
Total	£2321	0	0

Or per light—1080 at £2 3*s.*

No Fittings. Average distance 250 yards from dynamos.

No. 4.—INCANDESCENCE LIGHTING.

ESTIMATED COST OF INSTALLATION IN CHINA COURT.

Exhibitors.—The Gülcher Electric Lighting Company, Limited.

	£	s.	d.
Machine 43 " 44 " 45 } V. List at £300 . . .	900	0	0
" 46 at £200	200	0	0
Lanterns			
Inc. Lamps " Holders } 602 at 6*s*. . . .	180	12	0
Switches			
Cut-outs, 40 at 2*s*. 6*d*. each . . .	5	0	0
Leads, 5 miles nearly, at £39 per mile .	191	0	0
Mains Services }	20	0	0
Sundries	10	0	0
Cost of Labour Installation }	141	6	9
Total . .	£1647	18	9

Or per light—602 at £2 14*s*. 9*d*.

This is exclusive of coloured shades, costing about £40 extra.

The Installation was very far from the dynamo room, over 350 yards, raising the unit of cost.

No. 5.—INCANDESCENCE LIGHTING.

ESTIMATED COST OF INSTALLATION IN AQUARIUM AND WESTERN CORRIDOR.

Exhibitors.—Messrs. Ferranti, Thompson, and Ince.

	£	*s.*	*d.*
Machine 27, 1000 lights	950	0	0
Machine 28, 300 lights (£300)*			
Fittings, lent	135	0	0
Globes, lent			
Inc. lamps, 1000 at 6*s.*	300	0	0
„ holders, 1000 at 1*s.*	50	0	0
Leads	550	0	0
Mains Services	25	0	0
Sundries			
Cost of labour Installation	63	0	0
Total	£2073	0	0

1000 = per lamp £2 1*s.* 3*d.*

N.B.—Although this installation was never completed in consequence of non-supply of lamps, the above estimate is quite correct for 1000 lamps.

* This machine was used for a short time.

The wiring of the electroliers is not included in this.

Average distance 180 yards from dynamos.

ANALYSIS OF ELECTRIC LIGHT INSTALLATION COSTS.

A.—INCANDESCENCE SYSTEMS.

Name of Exhibitor.	Number of Machines.	Average Distance from Engines.	Total Cost.	Number of Lamps.	Average Cost per Lamp.	Remarks.
		Yards.	£ s. d.		£ s. d.	
1. "Swan" Co.	2	140	442 12 0	187	2 6 3	
2. E. V.	1	300	746 10 0	350	2 2 8	
3. Siemens	4	150	2,321 0 0	1,080	2 3 0	
4. Gülcher	4	350	1,647 8 9	602	2 14 9	
5. T. F. I.	2	180	2,073 0 0	1,000?	2 1 3	
Total cost of Incandescence Installations ..			£7,230 10 9	3,219	..	
			Average cost ..		£2 4 11	

NO. 1.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN WESTERN GALLERY, GREECE, ITALY AND FRANCE COURTS.

Exhibitors.—The Pilsen-Joel United Light Company.

	£	s.	d.
Machine 20, on Plan	300	0	0
Machine 21	300	0	0
Lamps, 26 at £12	312	0	0
Globes, &c., 26 at £2	52	0	0
Leads	35	0	0
Mains			
Services			
Sundries	3	10	0
Cost of labour Installation	13	14	8
Total	£1016	4	8

26 Arc Lamps, £38 6*s.* 4*d.* each.
Nom. c.p. 1000.

NO. 2.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN CONSERVATORY.

Exhibitors.—Messrs. Siemens Brothers & Co., Limited.

	£	s.	d.
Machine 26, on Plan	275	0	0
Lamps, 4 at £14	56	0	0
Globes, &c., 4 at £6 15*s.*	27	0	0
Cut-outs Leads Mains Services Sundries	282	0	0
Cost of labour Installation	30	0	0
Total	£670	0	0

Or per light—4 at £167 each.
Nom. c.p. 5500.

NO. 3.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN NETHERLANDS AND DENMARK COURTS.

Exhibitors.—Jablochkoff Electric Lighting Company, Limited.

		£	s.	d.
Machine 1 „ 2 „ 3 „ 4	(V. Plan) at £250 each	1000	0	0
Lamps, 64 at £5		320	0	0
Posts, 4 at £2 15*s.*		11	0	0
Fittings Globes	included in Lamp.			
Switches Cut-outs		12	0	0
Leads		350	0	0
Sundries				
Cost of labour Installation		94	3	6
	Total	£1787	3	6

Or per light—64 at £28 17*s.* 3*d.* each.
C.p. 350 actual.

NO. 4.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN DINING ROOMS.

Exhibitor.—C. Lever, Esq., Bowden, Cheshire.

		£	s.	d.
Machine 5 „ 6	Gramme, 2 at £90	180	0	0
„ 7 „ 8	Bürgin, 2 at £80	160	0	0
Lamps, 28 at £5		140	0	0
Leads		80	0	0
Cost of labour Installation		32	0	0
	Total	£592	0	0

Or per light, £21 2*s.* 10*d.*
Nom. c.p. 800 to 1200.

NO. 5.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN CANADA AND UNITED STATES COURTS.

Exhibitors.—Electrical Power and Light Contract Agency (per S. J. Mackie).

		£	s.	d.
Machine 11	(V. Plan)	120	0	0
" 12	Gramme	120	0	0
" 13		45	0	0
" 14		45	0	0
Lamps, 15 at £12 12*s.*		189	0	0
Globes, 15 at 30*s.*		22	10	0
Leads		75	0	0
Cost of labour Installation		20	0	0
	Total	£636	10	0

Or per light, £42 8*s.* 8*d.* each.

Nom. c.p. 2500.

NO. 6.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN THIRD CLASS REFRESHMENT ROOM AND NORWAY AND SWEDEN COURTS.

Exhibitors.—British Electric Light Company, Limited.

		£	s.	d.
Gramme H Machine 36 " H " 37	at £130 (see Plan)	260	0	0
" A " 38 " A " 39	2 at £60	120	0	0
Lamps, 14 at £13		182	0	0
Posts, 2 at £5		10	0	0
Fittings Globes Leads		55	3	6
Cost of labour Installation		28	18	11
	Total	£655	2	5

Cost per lamp, £41 1*s.* 6*d.* each.

Nom. c.p. 2000.

NO. 7.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN EASTERN CORRIDOR, PROMENADE AND MAST.

Exhibitor.—Hochhausen System—H. Edmunds.

	£	s.	d.
Machine 40, for 25 Lights and Regulator	450	0	0
„ 41, for 15 Lights „ „	310	0	0
„ 42, for 6 Lights	280	0	0
Lamps, 40 { 10 double, £16	160	0	0
31 single, £12	372	0	0
„ 6 at £20	120	0	0
Globes, 47 at 9*s.*	21	3	0
Lanterns included.			
Leads Mains Services Sundries	84	4	10
Cost of labour Installation	30	16	0
Total	£1828	3	10

Cost per lamp, £39 14*s.* 10*d.* each.

Nom. c.p. 1000.

NO. 8.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN MACHINERY IN MOTION AND ELECTRIC LIGHT SHEDS.

Exhibitors.—The Gülcher Electric Lighting Company, Limited.

	£	s.	d.
Machine 40 (V. Plan)	200	0	0
Fittings Globes } None.			
Lamps, &c., 22	75	0	0
Mains—say	25	0	0
Installation	30	0	0
Total	£330	0	0

22 at £15 each.

Nom. c.p. 500.

NO. 9.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN FISH MARKET AND PAVILION CORRIDOR.

Exhibitor.—Ball's Unipolar.

	£	s.	d.
Machine 31	120	0	0
Lamps, 7 at £7 7*s.*	51	9	0
Globes, 7 at 9*s.*	3	3	0
Lanterns included.			
Leads	32	16	0
Cost of labour Installation	11	14	0
Total	£219	2	0

7 at £31 6*s.* each.
Nom. c.p. 1000.

NO. 10.—ARC LIGHTING.

ESTIMATED COST OF INSTALLATION IN THE RUSSIAN AND SPANISH COURTS.

Exhibitors.—The Gérard Electric Lighting Company.

		£	s.	d.
Machine 32	Gérard	180	0	0
„ 33		60	0	0
„ 34	Siemens	120	0	0
„ 35		45	0	0
Lamps, 15 at £6 each		90	0	0
Lanterns included.				
Leads Mains Services		35	0	0
Cost of labour Installation		18	7	6
Total		£557	7	6

15 at £37 3*s.* 2*d.* each.
Nom. c.p. 800 to 1000.

ANALYSIS OF ELECTRIC LIGHT INSTALLATION COSTS.

B.—ARC SYSTEMS.

NAME OF EXHIBITOR.	Number of Machines.	Average Distance from Engines.	Total Cost.			Number of Lamps.	Average Cost per Lamp.			REMARKS.
		Yards.	£	s.	d.		£	s.	d.	
1. Pilsen-Joel Co..	2	150	1,016	4	8	26	38	6	4	
2. Siemens	1	500	670	0	0	4	167	0	0	
3. Jablochkoff Co.	4	160	1,787	3	6	64	28	17	3	
4. Lever	4	230	529	0	0	28	21	2	10	
5. Electric Power and Light Agency (Mackie)	4	125	636	10	0	15	42	8	8	
6. British Co.	4	225	655	2	5	14	46	15	6	
7. Hochhausen	3	510	1,828	3	10	46	39	14	10	
8. Gülcher	1	50	330	0	0	22	15	0	0	
9. Ball's Unipolar..	1	280	219	2	0	7	31	6	0	
10. Gérard Co.	4	230	557	7	6	15	37	3	2	
Total cost of Arc Installations ..			£8,291	13	11	241	..			
			Average cost ..				£34	8	$1\frac{1}{2}$	

APPENDIX C.

ANALYSIS of CARBONS used during the course of the EXHIBITION for the ARC INSTALLATIONS.

	Total Cost of Carbons.			Carbons used.		Lamp Hours run per Exhibition.	Estimated Candle Power.	Cost per lamp per hour.
				Top.	Bottom.			
	£	s.	d.					In pence.
Conservatory	20	4	1½	18 mm.	15 mm.	1,256	5500	3·88
Willard	11	15	0	15 mm.	15 mm.	1,104¼	1000	7.05
Gülcher	54	18	6	10 mm.	10 mm.	7,028	380	1·87
Edmunds	44	13	6	11 mm.	11 mm.	12,307	700	0·87
Mackie (Lea)	60	16	8	16 mm. 12 mm.	16 mm. 20 mm.	4,520¼	2500	3·25
Brockie	35	2	6½	13 mm.	13 mm.	4,176¾	2100	2·02
Jablochkoff	125	11	8	4 mm.	4 mm.	19,477½	350	1·55
Matthiesen	6	4	5½	..	..	380½	2000	3·91
Lever	39	11	4	10 mm.	10 mm.	7,870½	700	2·42
Gérard	26	0	4½	12 mm.	12 mm.	3,569	1000	1·75
Unipolar	9	7	2	12 mm.	12 mm.	802½	700	2·7
El. Lt. Supply Co. ..	7	3	10½	14 mm.	14 mm.	475	1000	2·71
Pilsen-Joel Co. ..	33	4	10	10 mm.	10 mm.	6,208	800	1·30
Total Expenditure ..	474	13	11½					

CEREMONIAL AT OPENING

OF

INTERNATIONAL FISHERIES EXHIBITION

AND

ADDRESSES AT CLOSING.

CEREMONIAL AT THE OPENING OF THE INTERNATIONAL FISHERIES EXHIBITION, MAY 12TH, 1883.

◆

The DUKE of RICHMOND and GORDON, K.G., Chairman of the General Committee, said,—May it please your Royal Highness,—The purpose of the International Fisheries Exhibition, which your Royal Highness is graciously pleased to open to-day on behalf of her Majesty the Queen, is to illustrate the present and past condition of one of the most ancient, extensive, and important of industries, and to promote that careful collection and discussion of facts by means of which alone we can hope to deal, in a satisfactory manner, with the many difficult practical and scientific problems connected with fish and fisheries. These buildings, which, large as they are, have proved hardly adequate to contain the vast contributions which have poured in upon us, are stored with the animal productions of the seas and rivers of all parts of the habitable globe, and with the multitudinous contrivances devised by human ingenuity for their capture. Every article of commerce yielded by fisheries is represented, and the agencies by which these articles are transported, distributed, and prepared for our use are exemplified. On our premises the consumer may not only become acquainted with the organization of a fish market, but may form a judgment, based on practical examination, of the vast possibilities open to judicious fish cookery. The various modes of preserving and multiplying aquatic animals, which come under the designation of fish culture, will be seen in action; while those who are interested in fishery law and in the history of fishing will find that the subject of their studies has not been neglected. It has been our especial aim to direct the attention of the public at large to the perils and hardships necessarily connected with the mode of life of those sea fishermen by whose labours they profit so largely; and we are not without hope that the creation of a general interest in their affairs may have a favourable influence on the condition of the fishing population. The melancholy loss of life suffered by seafaring people may certainly be diminished by the use of life-saving apparatus. The unprecedentedly large prize which we have offered for the best lifeboat has stimulated the ingenuity of inventors, and we are able to afford the public the opportunity of examining an unequalled collection of lifeboats and life-saving apparatus. It is obviously undesirable that the many experts who will be present during the Exhibition should go away without being afforded the opportunity of exchanging views on the complicated and disputed questions which arise in connection with fish and fisheries; and we therefore propose that an International Fishery Congress, for the discussion of such matters, shall be held during the Exhibition. It would have been impossible for us to have got together anything comparable to the great mass of objects illustrative of fisheries which we are able to exhibit without the countenance which has been accorded to us by

Her Majesty's Government, and without the generous spirit in which our applications for aid, supported by the Foreign and Colonial Offices, have been met by the Governments of foreign nations and those of our colonies. The contributions to the Exhibition derived from these sources must be seen and studied if their magnitude and importance are to be properly appreciated. We desire to take this earliest public opportunity of offering our thanks to the respective Governments and to their able and zealous representatives in charge of the vast and valuable collections which have been intrusted to our care. Our thanks are also due to those Colonial Governments, public bodies, and private supporters who have not only made munificent donations to the general funds of the Exhibition, but, also, following the precedent of the Exhibitions of 1851 and 1862, have become guarantors to a large amount, and have thereby enabled us to carry out our undertaking. Finally, Sir, permit us to make our grateful acknowledgments to yourself and to your Royal brother the Duke of Edinburgh, for the unwearied interest which your Royal Highnesses have taken in our work; and we desire to offer our especial thanks for the very powerful and effectual support which your Royal Highness has, from the first, been pleased to give to an undertaking which, we trust, may not only promote the interests of fisheries, of fishermen, and of fish consumers, but may also confer a lasting benefit on the seafaring population all over the world.

The PRINCE OF WALES replied,—My Lord Duke, my Lords and Gentlemen,—It gives me great pleasure to open this International Fisheries Exhibition on behalf of the Queen, although I feel assured that it is a matter of sincere regret to all present that her Majesty finds herself unable to undertake a duty which it would have afforded her much gratification to have performed. In view of the rapid increase of the population in all civilized countries, and especially in these sea-girt kingdoms, a profound interest attaches to every industry which affects the supply of food; and, in this respect, the harvest of the sea is hardly less important than that of the land. I share your hope that the Exhibition now about to open may afford the means of enabling practical fishermen to acquaint themselves with the latest improvements which have been made in their craft in all parts of the world; so that without needless destruction, or avoidable waste of any kind, mankind may derive the fullest possible advantage from the bounty of the waters. I am glad to hear that your attention has been directed to the condition of the fishing population. It is a subject in which my brother, the Duke of Edinburgh, was led to take a particular interest during his tenure of office as Admiral Superintendent of the Naval Reserve; and, as he is compelled to be absent during the sittings of the Congress to which you allude, I shall have the pleasure of reading a paper on this topic which he has prepared at its first meeting. Lifeboats and life-saving apparatus undoubtedly fall strictly within the province of a fishery exhibition; but I may congratulate you on the circumstance that, without overstepping your proper limits, you have been able to confer a benefit, not only on all fishermen and all sailors by profession, but also on all who travel by sea; and in these days of rapid and extensive locomotion this means a large proportion of civilized mankind. On behalf of the Queen, I add my thanks to those which you tender to the Governments of foreign nations and of our colonies for their generous co-operation. And to their representatives whose untiring exertions you so justly acknowledge, I offer not only thanks, but an English welcome.

The ARCHBISHOP OF CANTERBURY offered a prayer in these words,—Almighty God, Maker of all things, by whose gracious gift fish are multiplied innumerably in the waters; who hast made man to have dominion over the works of Thy hand, subjecting to him even whatsoever walketh through the paths of the sea; who by Thy Son Jesus Christ didst fill the nets of the Disciples when they had toiled all the night in vain; vouchsafe to bless the work here begun in Thy name, and prosper it still unto the due reverence and using of Thy gifts, the comfort of Thy poor, and the health and help of all people. Thou who dost instruct man in discretion, and dost teach him, make the skill of each nation to be the gain and vantage of all, that we may timely gather and thankfully enjoy the teeming harvests of the seas; through Jesus Christ our Lord. Amen.

The Collect, "Prevent us, O Lord," and the Lord's Prayer, followed.

(From the *Court Circular.*)

By command of the Queen and on Her Majesty's behalf his Royal Highness the Prince of Wales, K.G., opened the Industrial Fisheries Exhibition at South Kensington, on Saturday, May 12, at 12 o'clock.

The Foreign Ambassadors and Ministers, Her Majesty's Ministers, and other distinguished persons invited to be present, as well as the heads of Departments, Vice-Presidents, and Members of the General Committee, were shown to places near the daïs at 11.30 o'clock.

At a quarter to 12 o'clock their Royal Highnesses the Duke and Duchess of Edinburgh, with Prince Alfred of Edinburgh, arrived at the Exhibition, attended by Lady Harriet Grimston, the Hon. Mrs. Monson, Colonel the Hon. W. J. Colville, and Major Poore, R.M.A.

Their Royal Highnesses the Duke and Duchess of Connaught and Strathearn, and her Royal Highness the Princess Christian of Schleswig-Holstein arrived, attended by Colonel and the Hon. Mrs. Egerton, Lady Agneta Montagu, and Colonel G. G. Gordon.

Their Royal Highnesses the Duke and Duchess of Albany arrived, attended by the Hon. Mrs. R. Moreton and the Hon. A. Yorke.

His Royal Highness the Duke of Cambridge arrived, attended by Colonel Bateson, as also her Royal Highness the Duchess and his Serene Highness the Duke of Teck, G.C.B., with Lady Caroline Cust, and his Serene Highness the Prince Edward of Saxe-Weimar, G.C.B.

Their Royal Highnesses were received at the Entrance Hall by Her Majesty's Commissioners and the Executive Committee at a quarter to 12 o'clock, and awaited there the arrival of their Royal Highnesses the Prince and Princess of Wales.

Their Royal Highnesses the Prince and Princess of Wales, accompanied by their Royal Highnesses the Prince Albert Victor and Prince George of Wales, left Marlborough House at 11.30, attended by the great officers and others of Her Majesty's Household, and by their Royal Highnesses' Household-in-Waiting, and accompanied by a Captain's escort of the Royal Horse Guards.

The carriage procession was formed in the following order:—

FIRST CARRIAGE.

Colonel C. Teesdale, C.B., V.C., Equerry-in-Waiting to his Royal Highness the Prince of Wales.

Lieut.-Colonel Hon. W. Carrington, the Equerry-in-Waiting.

SECOND CARRIAGE.

Colonel G. J. Wigram, C.B., the Field Officer in Brigade Waiting.

Colonel J. S. Ferguson, the Silver Stick-in-Waiting.

Hon. A. T. Fitzmaurice, Groom-in-Waiting to his Royal Highness the Prince of Wales.

Admiral the Lord Frederick Kerr, the Groom-in-Waiting.

THIRD CARRIAGE.

Miss Knollys, Woman of the Bedchamber to her Royal Highness the Princess of Wales.

Lieutenant-General Sir Dighton Probyn, K.C.S.I., C.B., V.C., Comptroller and Treasurer to his Royal Highness the Prince of Wales.

The Lord Suffield, K.C.B., Lord-in-Waiting to his Royal Highness the Prince of Wales.

FOURTH CARRIAGE.

The Lord Thurlow, the Lord-in-Waiting.

The Lord Colville of Culross, K.T., Chamberlain to her Royal Highness the Princess of Wales.

Field-Marshal Lord Strathnairn, G.C.B., G.C.S.I., the Gold Stick-in-Waiting.

The Countess of Morton, Lady of the Bedchamber to her Royal Highness the Princess of Wales,

FIFTH CARRIAGE.

The Earl of Kenmare, K.P. . .	The Lord Chamberlain.
The Earl Sydney, G.C.B. . .	The Lord Steward.
The Duchess of Roxburghe . .	The Mistress of the Robes.
The Duke of Westminster, K.G.	The Master of the Horse.

SIXTH CARRIAGE.

His Royal Highness the Prince George of Wales.
His Royal Highness the Prince Albert Victor of Wales.
Her Royal Highness the Princess of Wales.
His Royal Highness the Prince of Wales, K.G.

On arrival at the Entrance Hall of the Exhibition their Royal Highnesses were received by Her Majesty's Commissioners and by the Executive Committee, and were joined by the other members of the Royal Family.

The Royal procession was then formed in the following order :—

The Contractor. The Architect.
The Superintendent of Works.
The Executive Committee.
The Foreign and Colonial Acting Commissioners.
The Lord Steward. The Lord Chamberlain.
Their Royal Highnesses the Prince and Princess of Wales.
The other members of the Royal Family.

Followed by the Master of the Horse, the Mistress of the Robes, the Chamberlain to her Royal Highness the Princess of Wales, and others of the Royal Households.

The procession passed through the British Sea Fisheries Gallery and through the Foreign Courts.

Upon the head of the procession reaching the Inland Fisheries Gallery the National Anthem was sung by the choir, consisting of 400 voices, under the direction of Mr. Barnby, accompanied by an orchestral band of seventy performers.

Their Royal Highnesses having been conducted to the daïs, and taken their seats, the Secretary of State for the Home Department took his place on the right of his Royal Highness the Prince of Wales.

The Duke of Richmond and Gordon, as President of the General Committee, then read to his Royal Highness the address which his Royal Highness, as President of the International Fisheries Exhibition, would have presented to the Queen, had her Majesty been present, to which his Royal Highness replied in her Majesty's name.

His Grace the Archbishop of Canterbury, who occupied a place on the daïs, offered up a special prayer for the occasion.

The choir having then sung the "Old Hundredth Psalm," his Royal Highness the Prince of Wales, in the Queen's name, declared the Exhibition open.

Her Majesty's State Trumpeters stationed near the daïs announced the event by a flourish of trumpets, and a Royal salute was fired by a battery of the Royal Artillery stationed in Hyde Park.

The "Marche Cortège" (*Reine de Saba*) having been played by the orchestral band, the Royal procession was re-formed in the same order as on arrival, and returned to the Entrance Hall and from thence to Marlborough House.

A guard of honour of the 1st Battalion of the Coldstream Guards, under the command of Lieut.-Col. Lockwood, was mounted at the entrance of the building, and a guard of honour of the Royal Naval Volunteers was stationed in the Entrance Hall.

Her Majesty's Hon. Corps of Gentlemen-at-Arms was on duty, under the command of Major Tillbrook, the Clerk of the Cheque and Adjutant, and was stationed near the dais. Captain J. Glas Sandeman was present on duty with the corps.

Her Majesty's Yeomen of the Guard were on duty in the building, under the command of Lieut.-Col. C. D. Patterson the Exon.

Her Majesty's Watermen were stationed in the line of the procession.

Levée dress was worn by all those who took part in the procession.

Ladies in morning dress.

ADDRESS OF MR. EDWARD BIRKBECK, M.P., CHAIRMAN OF THE EXECUTIVE COMMITTEE OF THE INTERNATIONAL FISHERIES EXHIBITION, TO HIS ROYAL HIGHNESS THE PRESIDENT, ON THE OCCASION OF THE CLOSING OF THE EXHIBITION ON THE 31ST OCTOBER, 1883.

◆

MAY IT PLEASE YOUR ROYAL HIGHNESS,

ON behalf of the Executive Committee, I have the honour to submit our Report in relation to the duties delegated to us by the General Committee of the Exhibition.

We would desire at the outset to express the deep sense of gratitude with which we, in common with all classes of the fishing community, recognise the gracious support which Her Majesty the Queen, as Patron, your Royal Highness, as President, and the other members of the Royal Family, as Vice-Presidents, have extended to the great enterprise, the executive work of which we have had the honour of undertaking. It is manifest that without this gracious recognition the complete success which we are proud to say has attended our efforts could not have been attained.

We, in common with Her Majesty's subjects generally, have greatly regretted the impossibility of Her Majesty's presence at the Fisheries Exhibition—although we know full well the gracious interest which Her Majesty has not ceased to take in the Exhibition from its very commencement.

It must be peculiarly gratifying to Your Royal Highness to feel that the warm interest which you have not ceased to take in International Exhibitions throughout your public career, is a continuation of the great work of developing the peaceful industries of the world, so brilliantly inaugurated by your illustrious father some thirty years ago.

From the very commencement, the labours of the Executive have been advanced and assisted by the members of Her Majesty's Government, both personally and through their respective Departments ; and this has tended to give that official status to the Exhibition, without which Foreign and Colonial Governments and important public institutions could not have rendered so effective a co-operation as that with which we have been honoured.

And here we desire to place on record the expression of our gratitude to that important and representative body of British Exhibitors, who, from the humblest Fishermen to the most eminent Engineers, have transmitted to us from all parts of the United Kingdom the results of their enterprise and skill.

Nor should we fail, at the commencement of our Report, to acknowledge also our debt of gratitude to the Court of the Worshipful Company of Fishmongers, to the County Committees, and to other public bodies, as well as to many private individuals, for the financial aid which they, without hope of gain, and with the possibility of loss, so promptly and generously afforded. Without this aid, so vast and costly an undertaking could not have been even contemplated ; and it is with especial gratification, that we can inform Your Royal Highness that our financial success has been such, that no contribution from the guarantors will be necessary.

The Foreign and Colonial Governments, who so cordially responded to our invitation to take part in the Exhibition, and who selected an exceptionally distinguished body of gentlemen to act as Commissioners, deserve our warmest thanks. These Commissioners have, by the hearty support we have received at their hands, and by the attractive arrangement and general effect of their respective Courts, contributed in the highest possible degree to the success of the Exhibition.

Without the untiring assistance of the many eminent men who have honoured us by acting on the several Sub-Committees which we found it necessary to appoint to initiate and supervise the Technical Departments of the Exhibition, we could not have presented these sections to the public with that accuracy and completeness which has been attained.

An efficient system of Juries engaged, at an early date, the particular attention of the General Committee, and no one could appreciate more thoroughly than ourselves the zeal and assiduity with which these gentlemen have acquitted themselves in their delicate and responsible functions; and we desire to express to Your Royal Highness how deeply we feel indebted to His Royal Highness the Duke of Edinburgh for the practical advice he has been pleased to render in this important Department.

The Special Commissioners appointed by Her Majesty's Government to receive and approve the awards of the International Jurors, have devoted many hours of valuable service to the onerous and responsible duties devolving upon them. His Royal Highness the Duke of Edinburgh will personally submit to Your Royal Highness their Report.

We also have pleasure in bringing to the notice of Your Royal Highness the efficient services and unremitting zeal with which the members of the Staff, in their different capacities, have carried out our instructions.

From the time when Your Royal Highness was pleased to declare the Exhibition open, the number of visitors has been uniformly large. Indeed, no one could have anticipated that the public interest would have been so keenly awakened, and so persistently sustained. We may be permitted to place on record that the total number of visitors who passed the turnstiles up to yesterday was 2,689,092, and that the daily average, including Wednesdays, when the price of admission was half-a-crown, has been 19,788.

No doubt a large proportion of this vast concourse has been due to the liberal arrangements which the railway companies co-operated with us to secure. From the commencement of the Exhibition, when they carried, without charge, the representative fishermen from the various ports to welcome Your Royal Highness at the opening ceremony, throughout the whole term of the Exhibition, when they conveyed fisherfolk at greatly reduced rates, to the close, when – notably the South-Eastern, the London, Chatham and Dover, the London, Brighton and South Coast, and the Metropolitan Companies—vied with each other in the exceptional facilities they afforded—they have all acted in a public-spirited manner, unexampled in previous Exhibitions, and have thus assisted to diffuse the knowledge which this great undertaking was designed to advance.

We are proud to be able to state that the order and decorum of these immense crowds have been most exemplary, not a single charge of disorderly conduct having been brought to our knowledge. Here it is natural to advert to the singular skill and discretion which have characterized the police arrangements, and the admirable way in which order and comfort have been secured to such large numbers of visitors.

Among so many portions of the Exhibition which have proved attractive to the public, it is difficult to select any for special mention ; but, as a novel feature, and especially affecting the outcome of the Exhibition, we may refer to the fish dinners supplied, with the co-operation of the National School of Cookery, to no less than 209,673 persons, at the moderate price of sixpence per head, and with satisfactory pecuniary results. It is hoped that the supply of this most nutritive diet at so small a cost, over 74 tons of which have been supplied in the dining-room specially decorated and set apart for its consumption, may have a far-reaching influence for good among the masses.

The Aquarium, erected at a very great cost, has been singularly attractive, and it is hoped that the decision we have arrived at, that it should be offered for the acceptance of the Nation through the medium of the Science and Art Department, will tend to keep alive that interest in all scientific questions bearing on the Fisheries which it was part of the aim of this Exhibition to promote.

The Exhibition has been most fortunate in finding a site large enough to provide for the erection of commodious detached buildings opening into pleasant grounds, the full advantages of which have for the first time been realised ; and Londoners have at length been able to bring their families to gardens, where they have had the opportunity of enjoying open-air music, as in other European cities.

The development of Electric Science has enabled us to call into requisition, in a hitherto unexampled manner, the electric light. In no previous undertaking of the kind have the extraordinary advantages of this method of lighting been so signally displayed, or has so large an area been dependent on its illuminating power. We would emphasize our deep obligation to the various companies and firms who have so liberally placed at our disposal their very valuable machinery and appliances, and who have given such attention to this feature of the Exhibition.

Our thanks are also due to the many eminent firms who have courteously lent for the adornment and purposes of the Exhibition, so many examples of their skill.

At no previous Exhibition has the desirability of gathering the opinions and experiences of the many distinguished men which such an enterprise naturally brings together been so systematically recognised. The Conferences—the proceedings of which have been published—the Handbooks, and the Essays contributed for competition, have epitomized and elucidated a subject vast in extent, and hitherto but little explored by men of letters. We are gratified to inform Your Royal Highness that the numerous applications we have received from public libraries and learned bodies, render it abundantly manifest that an important addition has been made to the literature of our time.

Your Royal Highness will naturally desire to learn what has been the financial result of the Exhibition. At the instant of its close it is not possible to state what has been the actual gain ; and if it be decided by Your Royal Highness to permit this Exhibition to be followed by others, the important question of the pecuniary responsibility for the cost of the buildings, which now devolves solely upon us, would be a matter for future arrangement, the result of which may materially augment the surplus. Your Royal

Highness will therefore readily understand that it would be premature at present to give any definite financial statement. We are, however, fully sensible of the responsibility devolving upon us as stewards of public money, and in due course such a statement will be submitted for the consideration of Your Royal Highness.

It is not possible in the brief compass of this Report to refer in anything like detail to what, we trust, will be the ultimate beneficial results of this Exhibition; not only to the Fisherman, by multiplying the safeguards against the loss of life inseparable from his perilous calling, but also by bringing to the homes of the poor the harvest of the waters. Your Royal Highness will learn with pleasure that the influence of the Exhibition for good is already manifest among the community whose interests it was designed to promote; and we trust that, when our work is concluded, that influence may be definitely and permanently continued. It is indeed strange that a subject of such vivid interest to us islanders should have remained so long in comparative obscurity; and we venture to congratulate Your Royal Highness upon having been the head of an undertaking destined, we believe, to bring to a prominence hitherto unattained the infinite resources of the sea.

REPORT OF HIS ROYAL HIGHNESS THE DUKE OF EDINBURGH, K.G., TO HIS ROYAL HIGHNESS THE PRESIDENT, WITH REFERENCE TO THE WORK OF THE JURIES.

THE Juries having carefully examined the several Exhibits brought under their notice, and recommended such Awards as in their opinion were justified by the merits of the various articles, their duties have now come to an end, with the exception, in one case, of practically testing the qualities of the Coast and Ship's Lifeboats, which has been necessarily postponed until after the closing of the Exhibition ; and the Special Commissioners think it right to say a few words on the constitution of the Juries, and the principles laid down for their guidance in the performance of their duties.

The Juries were, in almost every instance, composed of British, Colonial, and Foreign representatives.

The selection of the British Jurors was confided to a Special Jury Committee, composed of five members of the General Committee of the Exhibition ; and it was thought desirable to give the numerous members of this General Committee an opportunity of recommending suitable persons for the responsible duties of Jurors in the several Classes of Exhibits, and thus to provide a wide field from which the selections might be made. For this purpose, a

List of the several Groups of subjects, in which the numerous Divisions of the original Classification might be most conveniently arranged, was prepared and sent to each member of the General Committee, with a request that he would nominate such persons as he thought fitting for Jurors in any of the Groups. From these nominations the Jury Committee selected those gentlemen who appeared to them to possess the strongest qualifications, and recommended them for the approval of His Royal Highness the President.

The Commissioners for the several colonies were invited to nominate suitable Jurors wherever their services were desired; and the selection of the Foreign Jurors was, in every case, made by the Commissioners for their respective countries from the several well-qualified gentlemen appointed by their Government for this duty. The Jury Committee, in apportioning the number of Colonial and Foreign Jurors to each Group, endeavoured to secure the representation of those Countries or Colonies most interested in the subjects with which such Jury would have to deal.

Each of the Groups came under a separate Jury, and in several cases it became necessary to divide a Group into two or more Sections, with distinct Juries specially qualified to examine particular subjects. In connection with one of these Sections, the Special Commissioners desire to record their thanks to Mr. John Hartnup, Astronomer to the Liverpool Observatory at Bidston, Birkenhead, for the valuable and gratuitous assistance he has given to the Jury in determining the merits of chronometers exhibited by manufacturers in England and the United States, by testing them under varying conditions of temperature.

There were altogether 170 Jurors in the thirty-seven

Groups or Sections of Groups, and the number of Jurors in each ranged from nine to three, according to the importance and variety of the Exhibits to be examined. The time occupied by the Juries in their work varied also with the character and extent of the particular Exhibits ; and in the examination of the numerous fishing-craft, and the variety and abundance of cured fish—Exhibits of which were made by almost every country represented in the Exhibition—the Juries were occupied for as many as twenty-one days and sixteen days respectively.

The principles laid down for the guidance of the Juries were embodied in a printed paper of Suggestions, read to each Jury before they commenced their work, and copies of which were distributed to the Chairman and other Members. They were mainly the comparison, as much as possible, of like with like, and a consideration of the economical importance, no less than the intrinsic merits of any Exhibit.

It was decided by the Executive Committee that the Prizes should be of four classes, namely, Gold, Silver, and Bronze Medals, and Diplomas of Honour ; a Diploma being also given with each Medal. Besides these there were numerous Special Prizes of money offered by the Executive Committee, Corporations and private donors.

The number of Awards recommended by the Juries, and confirmed by the Special Commissioners, amounts to 1400 in all, including about 350 Gold Medals, 530 Silver Medals, 320 Bronze Medals, and 200 Diplomas of Honour.

One hundred and forty-three Essays on the various subjects for which Prizes had been offered have been submitted to the Special Juries, who kindly undertook the laborious task of examining them ; and the awards have been made in accordance with their recommendations.

The Special Commissioners have much satisfaction in acknowledging the valuable services of the Foreign and Colonial members of the several Juries, and particularly desire to thank the numerous British Jurors, many of whom, selected on account of their special technical knowledge in different departments of the fisheries, have given so much time and attention to the Jury work, and often, it is feared, at serious inconvenience to themselves.

The Exhibitors numbered about 3000, but amongst them are several Countries and Colonies represented principally or solely by Government Commissions.

In concluding their Report, the special Commissioners must express their obligations to Mr. Holdsworth, the Special Commissioner for Juries, for the constant and intelligent assistance he has rendered to them: also to the Members of the Staff, who, acting under his direction, have afforded efficient aid to the several Juries during their inquiries.

REPLY OF HIS ROYAL HIGHNESS, THE PRESIDENT OF THE INTERNATIONAL FISHERIES EXHIBITION, TO THE REPORT OF THE EXECUTIVE COMMITTEE, ON THE OCCASION OF THE CLOSING OF THE EXHIBITION ON THE 31ST OF OCTOBER, 1883.

I HAVE listened with great pleasure to the Report of the Executive Committee.

Her Majesty has followed with much interest the success which has so signally attended this Exhibition, and I have had the gratification of receiving, this morning, a telegram from The Queen, begging me to inform you of these sentiments, and likewise to express Her Majesty's fervent hope that lasting benefit to the fishing population may be the reward of those who have shown so much interest in the welfare of this Exhibition. And it is as much a matter of satisfaction to my brothers as to myself to have contributed towards the success of an enterprise, respecting which, at the outset, nothing was certain but the heavy responsibility of those who had engaged in it.

I am well aware that Her Majesty's Government, the Governments of Foreign Countries, and of our Colonies, through their respective Commissioners, and the various public bodies and private persons to whom you have alluded, have afforded most valuable and indeed indispensable aid to our undertaking; and I desire to add my own thanks to yours for their very important assistance.

But it is just that I should supply the only deficiency which I observe in your Report, by pointing out that without the administrative capacity and unremitting toil of the Members of the Executive Committee, and especially of its Chairman, the eminently satisfactory results which you have reported to me could not have been attained.

I learn with much pleasure that, after all expenses are defrayed, a substantial surplus will remain in your hands.

The best method of disposing of that surplus is a matter which will need careful consideration. It would be premature to allude to any of the various suggestions which have already been put forward; but I am of opinion that no proposal will be satisfactory to the public, unless it is immediately directed towards the carrying out of the objects of the Exhibition from which the fund is derived; namely, the promotion of the welfare of Fishermen, Fisheries, and the Fishing Industry in general.

And I think our duty towards the supporters of the Exhibition will not be discharged until we have done something towards the alleviation of the calamities fatally incidental to the Fisherman's calling; and until we have also done something towards the promotion of that application of Science to practice from which the Fishing Industry, like all other industries, can alone look for improvement.

I believe, that apart from what may be effected by the judicious use of the Surplus Fund, the latter end may best be attained by the formation of a Society, having for its object the collection of statistics and other information relative to Fisheries; the diffusion among the fishing population of a knowledge of all improvements in the methods and appliances of their calling; the discussion of questions bearing upon Fishing Interests; and the elucidation of those problems of Natural History which bear upon the subject. Such a Society, as the representative of the interests of the Fisheries, would naturally take charge of the scientific investigations which bear upon those interests, and would, no doubt, be brought into relation with the Aquarium which you wisely propose to offer to the Government, and with the already existing Fishery Museum of the Department of Science and Art, which is founded on the Collection bequeathed to the nation by the late Mr. Buckland, but which has been immensely enlarged and enriched by the liberality of many of our Exhibitors.

You have rightly divined that it is a source of great gratification to me to be able to continue the work commenced by my father in 1851; and, by giving scope for the peaceful emulation of the leaders of industry of all nationalities in public Exhibitions, to divert the minds of men from those international rivalries by which all suffer, to those by which all gain.

The evidence of the public interest in such Exhibitions, afforded by the vast concourse of visitors from all parts of the realm to that which is now closed, has led me to hope that the buildings which have been erected at so much cost, and which have so admirably served their purpose, shall continue for the next three years to be employed for Exhibitions of a similarly comprehensive character.

In considering what shall be the subject-matter of these Exhibitions, three topics of paramount interest to our community have presented themselves to my mind. These are Health, both bodily and mental; Industrial Inventions; and the rapidly-growing resources of our Colonies and of our Indian Empire.

I have expressed a desire that the Exhibition of 1884 will embrace the conditions of health, in so far as, like food, clothes, and dwellings, they fall under the head of Hygiene, or, like appliances for general and technical teaching, gymnasia and schools, under that of Education.

The question of the Patent Laws has for many years engaged the attention of all those interested in the progress of invention and the just reward of the inventor. I am advised that the Patent Act of last Session will afford a satisfactory solution of the difficulties which beset this subject, and will be especially useful to the poor inventor by enabling him to obtain protection for his invention at a considerably reduced rate, and in a manner which will be more advantageous to him.

Under these circumstances, it has appeared to me that much good may result from an Exhibition in the year 1885, showing the Progress of Invention, especially in labour-saving machinery since 1862; that is to say, since the last great International Exhibition held in this country.

At the close of the Paris Exhibition of 1868, I had the satisfaction of receiving from the Colonial Commissioners an address, in which great stress was laid on the desirability of establishing a permanent Colonial Museum in London, as a powerful means of diffusing throughout the Mother Country a better knowledge of the nature and importance of the several Dependencies of the Empire, of facilitating commercial relations, marking progress, and aiding the researches of men of science, and also of affording valuable information to intending emigrants.

At that time I was able to do little more than to assure the Commissioners of my readiness to promote such a scheme, and to recommend the respective Governments to give it their full consideration.

I trust that the British Colonial Exhibition which I propose to hold in 1886, may result in the foundation of such a Museum—the institution of which would secure for the people of this country a permanent record of the resources and development of Her Majesty's Colonies; and I hope that an important Section of the proposed Exhibition of that year may result from the co-operation of our fellow-subjects, the people of India, in a suitable representation of the industrial arts of that Empire.

In conclusion, I desire, as President of these Exhibitions, to thank the Special Commissioners, the Members of the General Committee, and the Jurors, for the time and labour they have devoted to the business of the Exhibition; and to express my high approbation of the cheerfulness and assiduity with which the members of the Executive Staff have discharged their very onerous duties.

And I must finally signalize, as especially deserving of our gratitude, my brother The Duke of Edinburgh, and the other Foreign and English gentlemen, to whom we are indebted for the bestowal of much time and thought upon the papers which have been brought before those Conferences, which have formed so interesting and so useful a feature of the Exhibition. I am glad to hear that the value of the contribution to Fishery Literature, effected by the publication of these papers and the discussions to which they gave rise, has received authoritative recognition.

REPORT OF THE EXECUTIVE COMMITTEE OF THE INTERNATIONAL FISHERIES EXHIBITION TO THE GENERAL COMMITTEE AT THE MEETING ON SATURDAY, MARCH 22ND, 1884.

THE General Committee was last called together in order that the Executive Committee might be empowered to announce the closing of the Exhibition, and also that it might procure authority to enter into negotiations with a view to the subsequent application of these buildings.

The present meeting has been summoned for the purpose of reporting the action of the Executive Committee under these powers; of learning what have been the financial results up to the present time; and in order that the Executive Committee may be authorized to carry on the future duties which the success of the Exhibition has happily rendered necessary.

A few days subsequent to the last meeting, the Loan, which had been raised on the guarantee fund, was finally liquidated; and the Executive Committee have lately had the pleasure of definitely announcing to the guarantors that it has been found unnecessary to take advantage of their generous co-operation. From the date of the liquidation, the financial success of the Exhibition was assured. The large daily number of visitors, referred to by the Committee in their last report, fully sustained its high average throughout the fine autumn months; and indeed, during the last fortnight in October, when liberal railway arrangements brought crowds of excursionists, the numbers greatly exceeded this average, amounting as they did, on the last Monday and Tuesday on which the Exhibition was open, to over 100,000 in the two days.

The total number of visitors, including free admissions, was 2,703,051, showing a daily average of 18,388. An exhaustive return of these admissions will be attached to the Official Report.

Notwithstanding this undiminished popularity, it was considered advisable, owing to the lateness of the season, and in deference to the wish of the Colonial and Foreign Commissioners and many English exhibitors, to announce the close for the 31st of October.

A few days previous to this date, the Jury Awards, having received the confirmation of the Special Commissioners appointed by Her Majesty's Government, were made known. The names of the successful competitors of Special Prizes and of Prize Essays were also notified. The Medals and Money Prizes have, with one exception, all been distributed. The Diplomas, however, owing to the elaborate design and the laborious process of reproduction, are not yet ready for delivery. Full details of the working of the Jury Department are given in the Report which was read by His Royal Highness the Duke of Edinburgh at the closing ceremony, a copy of which will be found on page 262.

On the 31st of October, His Royal Highness the Prince of Wales as President declared the Exhibition closed, in the presence of their Royal Highnesses the Dukes of Edinburgh, Albany and Cambridge, the Earls Granville and Northbrook, and Sir William Harcourt, and many Vice-Presidents, Foreign and Colonial Commissioners, Members of the General Committee, Jurors, Councils of learned Societies, and others. In the Address * then presented by the Executive Committee to His Royal Highness, a general survey of the Exhibition was attempted and its main features were chronicled. The Committee feel convinced that, in recording on that occasion their deep sense of gratitude for the public and private assistance which was throughout the term of the Exhibition so readily accorded, they fully expressed the feelings of the General Committee.

With regard to the Financial Results of the Exhibition, so far as these can be at present ascertained, up to this date the total expenditure has been £131,392 6*s.* 1*d.*, and the total receipts £140,346 13*s.* 0*d.*, thus leaving a balance of £8,954 6*s.* 11*d.* The items of this expenditure, which will ultimately appear in the official publications, need but little comment on the part of the Executive Committee. The sums paid for the erection of the buildings will take naturally a leading place; and it is with great satisfaction that the Committee can report that, though of a temporary character, these buildings have, from their admirable construction, stood well the test of use and weather, and are at present, to all appearances, as strong and serviceable as when they were erected. The Aquarium, which was completed at considerable cost, is likely to become of permanent value: and it may be here stated that, as the Government have not yet been able to give a decided answer to the proposal that the Aquarium should become a portion of the Science and Art Department, arrangements have been made whereby the National Fish Culture Association will maintain it during the present year. Under the head of Working Expenses will be summarized the cost of staff, attendants and labourers, of the maintenance of the Aquarium, of the electric light installation and expenses, as well as of the musical arrangements, the illuminating of the gardens and other attractions, the public appreciation of which need scarcely be referred to: these attractions, so peculiarly a feature of the Exhibition, were carried on with more liberality, perhaps, than would have been justifiable in a strictly commercial undertaking. The Publications issued by the Committee also form a large item in the expenditure; and to these may be added, as special charges, the cost of Advertisements, the Rent paid to Her Majesty's Commissioners for the Exhibition of 1851 for the use of the ground, and the cost of producing the Medals, which were struck, by special authority, at the Royal Mint.

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* See page 255.

The Receipts are, of course, almost entirely due to the admissions to the Exhibition. These admissions consisted of: (1) Those paying at the doors; (2) Holders of tickets of admission given up at the doors; (3) Holders of railway tickets; (4) Season ticket holders; and (5) Free admission to fishermen, and complimentary admissions to officials, members of the Press and exhibitors, members of the Royal Horticultural Society and others. Certified parties of school children were admitted during the last weeks of the Exhibition at half-price.

It is desirable that we should here mention that—with a view of inducing the Railway Companies (and particularly those comprising that which is known as the Metropolitan system) to afford all possible facilities to the public—arrangements were sanctioned, involving a reduction of 25 per cent. on tickets combining the travelling fare and admission to the Exhibition. In certain instances special privileges were accorded to large parties whose claims seemed specially worthy of consideration, involving no less a reduction than 50 per cent. This extensive concession was also applied in the case of the popular excursions organized with the co-operation of three of the southern trunk railways during the month of October. The wisdom of this policy is best illustrated by the fact that 878,703 persons purchased tickets on the District, the Metropolitan, and the suburban lines of the Great Western and London and North Western Railways, which combined the travelling fare and admission to the Exhibition. The statistics furnished by the Companies show that the South Kensington joint station of the District and Metropolitan Railways was used by upwards of 2,000,000 of the visitors between May 14th and October 30th. A large percentage of this number was admitted on production of the special tickets supplied to the railway bookstalls, established booksellers and various recommended agents, to whom a remunerative commission was allowed. The popular excursions from the south eastern and southern districts during the last three weeks of the Exhibition attracted 91,060 visitors, who were almost exclusively identified with the artizan and agricultural communities, being an average of more than 30,000 per week. It is reasonable to conjecture that, had it not been for the liberal arrangements made in their interests, very few of these visitors would have become personally acquainted with the Exhibition.

It must not be supposed that the foregoing statement is in any way final, for there are naturally a few liabilities still pending, and it is almost certain that a substantial addition will be made to the surplus in the next few years. This leads to the consideration of the immediate future, and of the utilization of these buildings, to which reference was made in the reply * which His Royal Highness the Prince of Wales was pleased to make to the Address of the Executive Committee at the Closing Ceremony. The Executive Committee are happy to be able to state that the negotiations to which they referred in their last Report have ended very favourably, and that Her Majesty's Commissioners for the Exhibition of 1851 have assented to the principle of other Exhibitions being held in these buildings. The International Health Exhibition, which is to be opened in May, gives every promise of success, and this Exhibition will be immediately followed in 1885 by an International Exhibition of Inventions, and in 1886 by an Exhibition of the Colonial and Indian Empires, announcements concerning both of which are on the eve of being made. A rental of £5000 will be paid by the International Health Exhibition as a first charge on its profits, and each of the other Exhibitions will be called upon to pay at least an equal rental. Thus it may be fairly anticipated that by 1886 a considerable increase will have been made to the present surplus.

With regard to the disposal of the surplus, the wishes of His Royal Highness the Prince of Wales, who has expressed on two public occasions his desire to promote the welfare of fishermen, fisheries and the fishing industry in general, demand our respectful consideration. His Royal Highness gave expression to this opinion not only at the closing of this Exhibition,* but also previously at the National Fisheries Exhibition at Norwich. It now therefore remains for the General Committee to-day to give practical effect to the wishes so emphatically expressed by

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* See page 266.

His Royal Highness, and to indicate to the Executive Committee the precise purposes to which the surplus shall be appropriated.

In again reviewing the past, and in attempting to estimate the good which the Exhibition may fairly claim to have effected for the industry it was designed to encourage, the Executive Committee would desire to bring prominently to notice a few special features. The first is the inducements that were offered to fishermen to visit the Exhibition, and the opportunity thereby given to them of observing and comparing the different methods of pursuing the same craft as employed by their countrymen and by foreigners. The importance of this means of education was frequently brought to the notice of the Committee; and especially when the financial success of the Exhibition was assured, they considered themselves more than justified in having adopted and in continuing to pursue a liberal policy in regard to the free admission of all persons connected with the fishing industry—a policy the more easily effected when the liberal arrangements of the railway companies were taken into account.

Secondly, the use and value of many sorts of Fish hitherto almost unknown to the British public, which were daily seen on the Fish Market, were fully demonstrated by the arrangements with the National Training School of Cookery, which, at a very small cost and yet with a fair commercial profit, provided cheap fish dinners throughout the period of the Exhibition. It only remains for the Executive Committee to express a hope that, by a reduction of the railway fish freights, the full benefit of this experience may be secured to the masses.

The third, and perhaps even most important feature of the Fisheries Exhibition, and one which it is earnestly to be hoped will have a lasting and valuable result, is the Literature, which is composed of Handbooks, Conference Papers and Essays. It was perhaps a natural outcome of the Exhibition that it should bring together in one place experts on sea and river fisheries and on all the appliances and theories connected therewith. The recognition of this fact induced the Executive Committee to cause letters to be addressed at a very early period to foreign countries and to the Colonies, which resulted in most valuable digests being furnished by their respective Governments.

During the summer, Conferences, presided over by His Royal Highness the Prince of Wales, by Foreign Ambassadors, by Members of Her Majesty's Government, and by other distinguished men, were held almost daily : at these not only were papers of exceptional importance read by the highest authorities ; but discussions resulted, which go far to elucidate many difficult problems. A series of twenty Handbooks, by authorities equally distinguished, was also projected and successfully carried out. These several productions, published separately from time to time, are being collected into the form of a series of seven volumes, to which must be added four volumes of Prize Essays and the Official Report on the Exhibition, for which the Executive Committee are indebted to his Excellency Mr. Spencer Walpole. To the whole of this literature will be added an Analytical Index.

Such a contribution to the literature of the subject of fisheries could only be secured by a very considerable expenditure, and had this feature not been already carried out as a part of the ordinary working expenses of the Exhibition a considerable portion of the surplus might reasonably have been voted to secure its execution.

In concluding this report, the Executive Committee wish to express a hope that they have satisfactorily discharged the functions confided to them by the General Committee of the International Fisheries Exhibition; and they now ask that power may be vested in them to carry on in the future the work connected with the Exhibition, so that it may not be necessary to again summon the General Committee.

(Signed)

By order of the Executive Committee,

EDWARD BIRKBECK,

Chairman.

THE INTERNATIONAL FISHERIES EXHIBITION, 1883.

FINANCIAL STATEMENT.

Liabilities.	£	s.	d.	*Assets.*	£	s.	d.
Unpaid Accounts	150	3	11	Cash at Bankers	8,954	6	11
Diplomas	759	18	0	Rent due by Health Exhibition .	5,000	0	0
Life Boat Prize to be awarded .	600	0	0	Advance to ditto .	1,000	0	0
Balance of Assets over Liabilities	15,243	0	8	Valuation of Furniture. . . .	1,564	5	8
				Due by Railway Companies, &c. .	234	10	0
	£16,753	2	7		£16,753	2	7

To this balance may be added rental from Exhibitions of 1885 and 1886.

The PRINCE OF WALES then said,—You have all listened, I am sure, with great interest to the report that has been read to you by the Chairman of the Executive Committee. From what we have heard, I think it is patent to all that the late Fisheries Exhibition has in every point of view been a success. It has been a financial success, and it has also been a success as regards the enormous number of people who have visited it, not only of our own countrymen and those from our colonies, but from every part of the globe. It is unnecessary for me on an occasion of this kind to enumerate the objects of this Exhibition, but I maintain that its two salient objects—viz., the scientific and practical ones, have fully justified its existence—its scientific object by the display of every possible kind of modern appliance, thus showing the great improvements that have been made in the fishing industry of the world; and its practical object because it not only showed to our own countrymen, but to all the world, what a valuable means of subsistence fish is. Many, I believe, had no idea of its value; while the existence of varieties of fish was made known which had not even been heard of by the great majority of people. Well, gentlemen, you have all heard that there is a surplus amounting to £15,243, and the question is naturally how to employ that sum. In the address that I read to you at the closing of the Exhibition I held out some hope that this might be applied in a useful and practical manner, and I would therefore now suggest to the General Committee that one of the best objects by which to perpetuate the results of this successful Exhibition would be to appropriate, say, about £10,000 to alleviate the distress of widows and orphans of sea fishermen. I use the words "alleviate the distress" because I do not wish to bind any of you to our erecting an orphanage. That would cost a great deal of money, and, I think, would possibly be a mistake. If we were to embark in any great building enterprise of that kind, and in future find ourselves in debt, we should have frustrated the very object we have in view, viz., supporting the widows and orphans of those brave men who peril their lives at sea. I would also suggest that £3000 should be given as an endowment to a society, which might be called the Royal Fisheries Society. What shape that might take will be for your future consideration; but possibly some society might be founded under such a name or character, similar to the Royal Agricultural Society. We shall then have a surplus of about £2000 left, which, I think you will all agree, will be a good thing to keep in reserve. It would be for the general public in future to show their interest in this scheme by supporting it to the best of their ability. I beg, therefore, to move the following resolution:—"That a sum of £10,000 be invested, with a view to applying the proceeds to the assistance of families who have suffered the loss of a father or husband in the prosecution of his calling as a sea fisherman; and that a further sum of £3000 be applied to the formation of a Fisheries Society, such as was suggested by His Royal Highness the President in his reply to the report of the Executive Committee on the 31st of October, 1883."

[That suggestion was that a society should be formed, having for its object the collection of statistics and other information relative to Fisheries; the diffusion among the fishing population of a knowledge of all improvements in the methods and appliances of their calling; the discussion of questions bearing upon fishing interests; and the elucidation of those problems of natural history which bear upon the subject.]

STATISTICAL TABLES.

I. RETURN SHOWING SALE OF OFFICIAL PUBLICATIONS DURING THE TERM OF THE EXHIBITION.

	Number of Visitors.	Catalogues. 1s.	Plan. 1d.	Cookery Book. 3d.	Musical Programme. 2d.	Catalogues. 2s. 6d.	Fisheries Guide. 3d.	Fisheries Portfolio. 15s.	Handbooks.	Conference Papers.	Jury Awards. 1s.	Programmes given away.	Opening Programme. 1s.	Closing Programme. 6d.
S. May 12 about ..	20,000	1,062	..	..	..	..	..	..	..	..	..	..	743	..
M. ,, 14	42,941	3,319	4,218	326	2,077	..	..	..	..	..	..	..	..	..
T. ,, 15	29,446	2,241	4,680	554	603	..	..	..	..	..	..	..	..	..
W. ,, 16	9,198	1,581	815	274	276	..	..	..	..	..	..	..	..	..
T. ,, 17	18,514	1,981	1,463	975	356	..	..	..	..	..	..	..	..	..
F. ,, 18	16,100	1,382	1,230	1,121	249	..	..	..	..	..	..	..	..	..
S. ,, 19	16,750	1,735	1,180	855	279	..	..	..	..	..	..	..	..	..
M. ,, 21	12,780	1,073	623	682	298	..	..	..	..	..	..	..	..	..
T. ,, 22	16,662	1,387	904	891	259	..	..	..	..	..	..	..	..	..
W. ,, 23	10,945	1,313	604	578	326	9	..	..	..	..	..	..	..	..
T. ,, 24	16,026	1,434	984	772	418	..	..	..	..	..	..	..	..	..
F. ,, 25	11,508	1,002	754	663	459	..	..	..	..	..	..	..	..	..
S. ,, 26	19,114	1,691	1,666	664	520	..	..	..	..	..	..	..	..	..
M. ,, 28	11,220	841	711	388	545	..	..	..	..	..	..	..	..	..
T. ,, 29	12,457	1,008	883	508	541	3	..	..	..	..	..	..	..	..
W. ,, 30	7,194	841	482	344	369	2	..	..	..	..	..	..	..	..
T. ,, 31	13,472	930	1,051	541	619	2	..	..	..	..	..	..	..	..
F. June 1	11,414	809	895	437	524	2	..	..	..	..	..	..	..	..
S. ,, 2	15,380	844	1,506	395	707	1	..	..	..	..	..	..	..	..

M. ,, 4	12,767	636	1,175	341	652	3	..	..	..	..	..	..	..	..
T. ,, 5	13,159	795	1,087	417	631	2	..	..	..	..	..	..	..	..
W. ,, 6	7,142	663	625	338	547	1	..	..	..	..	..	..	..	..
T. ,, 7	13,358	794	1,393	414	502	1	..	..	..	..	..	..	..	..
F. ,, 8	11,451	683	994	454	572	3	..	..	..	..	..	..	..	..
S. ,, 9	15,547	689	1,457	333	705	3	..	..	..	..	..	..	..	..
M. ,, 11	13,691	714	976	404	461	1	..	..	..	..	..	..	..	..
T. ,, 12	14,525	740	1,082	387	686	1	..	..	..	..	..	..	..	..
W. ,, 13	6,411	529	679	253	475	4	..	..	..	..	..	..	..	..
T. ,, 14	14,175	705	1,273	359	675	2	..	..	..	..	..	..	..	..
F. ,, 15	14,255	586	1,139	485	576	3	..	..	..	..	..	..	..	..
S. ,, 16	18,494	729	1,738	391	781	6	..	..	..	..	..	..	..	..
M. ,, 18	14,145	534	1,190	413	757	2	..	..	..	..	..	..	..	..
T. ,, 19	14,688	603	1,149	482	752	4	..	..	..	72	..	..	..	..
W. ,, 20	6,301	435	624	295	503	4	..	..	..	30	..	..	..	..
T. ,, 21	14,197	644	1,122	461	666	1	..	..	17	41	..	..	..	..
F. ,, 22	12,227	515	831	363	623	4	..	..	12	34	..	..	..	..
S. ,, 23	19,560	632	1,148	327	756	1	..	..	6	18	..	..	..	..
M. ,, 25	12,830	482	868	359	566	6	..	..	10	15	..	..	..	..
T. ,, 26	14,413	648	1,031	430	622	4	..	..	12	16	..	..	..	..
W. ,, 27	6,199	403	475	225	401	4	..	1	14	14	..	..	..	..
T. ,, 28	17,919	681	1,073	388	706	6	..	..	15	10	..	..	..	..
F. ,, 29	11,443	461	404	297	597	2	..	..	9	10	..	..	..	..
S. ,, 30	19,684	534	1,048	274	856	1	..	..	4	11	..	..	..	..
M. July 2	11,620	362	725	230	706	..	..	..	4	8	..	..	..	..
T. ,, 3	15,030	456	706	199	706	..	..	..	2	7	..	..	..	..
W. ,, 4	5,243	258	286	153	..	2	..	..	16	2	..	3,433	..	..
T. ,, 5	14,816	470	771	242	705	4	..	..	19	8	..	..	..	..
F. ,, 6	11,684	379	610	221	704	1	..	..	15	7	..	..	..	..
S. ,, 7	20,132	574	1,029	221	1,162	1	..	..	15	6	..	..	..	..
M. ,, 9	16,027	429	831	242	707	..	..	..	13	9	..	..	..	..
T. ,, 10	20,635	623	1,287	336	952	3	..	..	8	22	..	..	..	..
W. ,, 11	6,774	302	487	175	..	4	..	1	28	32	..	2,500	..	..
Carried forward ..	751,663	45,162	55,962	21,877	30,135	103	..	2	219	372	..	5,933	743	..

	Number of Visitors.	Catalogues. 1*s.*	Plan. 1*d.*	Cookery Book. 3*d.*	Musical Programme. 2*d.*	Catalogues. 2*s.* 6*d.*	Fisheries Guide. 3*d.*	Fisheries Portfolio. 15*s.*	Handbooks.	Conference Papers.	Jury Awards. 1*s.*	Programmes given away.	Opening Programme. 1*s.*	Closing Programme. 6*d.*
Brought forward ..	751,663	45,162	55,962	21,877	30,135	103	..	2	219	372	..	5,933	743	..
T. July 12	15,886	580	1,165	319	1,049	3	..	1	16	12	..	..	..	..
F. ,, 13	13,934	441	745	256	1,147	..	..	1	23	20	..	..	..	..
S. ,, 14	20,919	512	1,055	214	1,434	1	..	..	17	16	..	..	..	..
M. ,, 16	17,026	424	800	226	1,152	33	..	..	12	9	..	..	..	..
T. ,, 17	17,709	539	864	274	1,130	28	..	..	9	4	..	..	..	..
W. ,, 18	2,983	204	176	95	..	..	..	..	6	3	..	2,000	..	..
T. ,, 19	19,164	605	844	289	1,184	6	..	1	11	3	..	..	..	..
F. ,, 20	12,371	546	703	254	904	3	..	..	10	5	..	..	..	..
S. ,, 21	23,058	657	1,049	223	1,998	..	..	..	9	4	..	..	..	..
M. ,, 23	17,474	551	758	238	1,084	..	..	..	10	20	..	..	..	..
T. ,, 24	20,992	609	834	262	1,384	..	..	..	17	13	..	..	..	..
W. ,, 25	3,155	226	225	124	..	..	..	..	12	9	..	2,000	..	..
T. ,, 26	21,106	579	682	191	1,435	..	..	..	15	26	..	..	..	..
F. ,, 27	14,856	501	598	211	1,226	..	..	..	16	27	..	..	..	..
S. ,, 28 .. .	26,351	586	835	168	2,191	..	..	..	7	38	..	..	..	..
M. ,, 30	17,353	493	534	189	1,206	..	..	..	3	22	..	..	..	..
T. ,, 31	19,378	534	634	224	1,415	..	..	..	18	38	..	..	..	..
W. Aug. 1	8,131	304	321	122	..	..	..	..	10	12	..	3,950	..	..

T. ,, 2	22,686	594	1,013	281	1,716	..	..	..	16	9	..	..	..	..
F. ,, 3	17,108	389	825	247	1,726	..	..	..	7	20	..	..	..	..
S. ,, 4	21,992	429	847	235	2,525	..	..	..	0	4	..	..	..	..
M. ,, 6	55,868	679	2,624	291	3,986	2	..	..	5	6	..	..	..	..
T. ,, 7	30,765	547	1,465	301	1,853	1	..	..	9	16	..	..	..	..
W. ,, 8	6,597	275	370	166	..	1	..	..	5	38	..	2,700	..	..
T. ,, 9	21,964	473	1,039	270	1,422	..	..	..	9	79	..	..	..	..
F. ,, 10	15,779	390	762	239	1,026	..	..	..	2	12	..	..	..	..
S. ,, 11	20,494	398	916	230	1,942	2	..	..	9	38	..	..	..	..
M. ,, 13	20,502	375	926	214	1,267	..	..	..	6	5	..	..	..	..
T. ,, 14	19,618	339	462	227	999	1	397	..	5	15	..	..	..	..
W. ,, 15	7,192	223	69	139	..	1	225	..	2	4	..	3,900	..	..
T. ,, 16	20,423	385	219	180	1,329	3	588	..	13	30	..	..	..	..
F. ,, 17	12,922	268	162	172	865	2	445	..	5	21	..	..	..	..
S. ,, 18	20,153	286	203	171	1,831	1	584	..	8	22	..	..	..	..
M. ,, 20	20,862	302	211	191	1,296	2	595	..	4	10	..	..	..	..
T. ,, 21	20,365	326	349	213	1,425	..	574	..	15	40	..	..	..	..
W. ,, 22	7,810	199	113	104	..	..	217	..	4	3	..	3,950	..	..
T. ,, 23	20,954	343	273	222	1,448	1	519	..	6	10	..	..	..	..
F. ,, 24	13,738	236	288	225	1,037	..	426	..	2	11	..	..	..	..
S. ,, 25	23,163	268	333	179	1,663	..	497	..	6	15	..	..	..	..
M. ,, 27	18,801	252	286	206	1,140	..	388	..	2	2	..	..	..	..
T. ,, 28	21,847	355	542	231	1,311	..	529	..	4	5	..	..	..	..
W. ,, 29	8,432	205	106	139	..	..	240	..	7	20	..	3,780	..	..
T. ,, 30	19,582	297	365	185	1,155	1	500	..	3	3	..	..	..	..
F. ,, 31	10,622	185	329	137	627	2	314	..	5	3	..	..	..	..
S. Sept. 1	32,817	391	649	202	1,822	1	677	..	3	10	..	..	..	..
M. ,, 3	18,359	228	421	193	841	1	373	..	6	3	..	..	..	..
T. ,, 4	20,413	304	436	205	1,030	..	544	..	6	2	..	..	..	..
W. ,, 5	6,811	182	135	110	..	1	173	..	6	11	..	4,000	..	..
T. ,, 6	19,026	307	360	162	821	3	474	..	9	14	..	..	..	..
F. ,, 7	13,008	205	297	169	825	1	363	..	10	17	..	..	..	..
S. ,, 8	32,063	299	527	144	2,648	1	623	..	5	12	..	..	..	..
Carried forward ..	1,686,245	64,987	86,706	32,336	91,650	205	10,265	5	644	1163	..	32,213	743	..

	Number of Visitors.	Catalogues. 1*s.*	Plan. 1*d.*	Cookery Book. 3*d.*	Musical Programme. 2*d.*	Catalogues. 2*s.* 6*d.*	Fisheries Guide. 3*d.*	Fisheries Portfolio. 15*s.*	Handbooks.	Conference Papers.	Jury Awards. 1*s.*	Programmes given away.	Opening Programme. 1*s.*	Closing Programme. 6*d.*
Brought forward ..	1,686,245	64,987	86,706	32,336	91,650	205	10,265	5	644	1163	..	32,213	743	..
M. Sept. 10	17,530	259	384	173	957	1	449	..	3	3	..	..	..	..
T. ,, 11	15,675	233	301	165	656	..	438	..	0	3	..	..	..	..
W. ,, 12	7,547	179	144	81	..	1	198	..	4	3	..	3,426	..	..
T. ,, 13	19,526	295	312	223	1,226	1	452	..	7	4	..	..	..	..
F. ,, 14	12,839	193	237	105	1,008	1	328	..	4	10	..	..	..	..
S. ,, 15	37,741	267	421	135	3,326	4	591	..	4	6	..	..	..	..
M. ,, 17	21,665	260	313	171	1,162	2	431	..	4	5	..	..	..	..
T. ,, 18	20,151	251	306	155	1,352	..	389	..	1	10	..	..	..	..
W. ,, 19	9,833	170	191	100	..	1	233	..	6	2	..	4,000	..	..
T. ,, 20	16,410	274	280	144	858	1	369	..	4	7	..	..	..	..
F. ,, 21	10,571	180	202	104	657	..	254	..	6	6	..	..	..	..
S. ,, 22	37,764	291	380	123	2,825	1	639	..	7	31	..	..	..	..
M. ,, 24 . ..	16,546	224	196	127	833	1	358	..	6	8	..	..	..	..
T. ,, 25	17,370	232	244	133	961	..	371	..	4	16	..	..	..	..
W. ,, 26	7,769	157	139	64	..	..	182	..	6	22	..	2,775	..	..
T. ,, 27	14,896	230	289	144	773	3	359	..	1	3	..	..	..	..
F. ,, 28	9,435	144	187	97	548	1	219	..	4	7	..	..	..	..
S. ,, 29	25,486	223	331	112	1,433	1	429	..	2	7	..	..	..	..

M.	Oct.	1	17,610	164	259	188	702	5	304	..	5	10	..	..	..	..
T.	,,	2	16,959	214	251	162	823	..	307	..	2	0	..	..	..	..
W.	,,	3	5,201	118	116	65	..	1	152	..	1	9	..	2,510	..	..
T.	,,	4	12,097	178	124	119	552	2	242	..	10	2	..	..	..	..
F.	,,	5	9,016	129	178	130	506	..	237	..	4	4	..	..	..	..
S.	,,	6	33,781	262	381	151	2,337	..	460	..	7	12	..	..	..	..
M.	,,	8	16,697	180	214	167	746	..	257	..	2	4	..	..	..	..
T.	,,	9	15,172	172	176	151	824	1	288	..	3	5	..	..	..	..
W.	,,	10	8,718	199	145	114	..	1	189	..	11	14	..	3,704	..	..
T.	,,	11	18,675	277	258	175	993	1	357	..	3	10	..	..	..	..
F.	,,	12	11,032	150	207	173	602	..	236	..	8	8	..	..	..	..
S.	,,	13	51,973	277	600	219	3,035	30	680	..	6	15	..	..	..	..
M.	,,	15	29,039	83	291	286	984	55	566	..	5	10	..	..	..	..
T.	,,	16	27,777	229	301	231	906	..	395	..	7	12	..	..	..	..
W.	,,	17	10,185	222	176	179	..	..	255	..	2	20	219	3,744	..	..
T.	,,	18	28,641	216	386	196	851	..	407	..	14	27	51	..	..	..
F.	,,	19	14,098	194	242	148	526	..	295	..	14	24	18	..	..	..
S.	,,	20	56,422	247	428	170	2,501	..	665	..	8	3	22	..	..	..
M.	,,	22	34,413	234	246	221	765	..	397	..	7	15	10	..	..	..
T.	,,	23	30,595	218	333	216	716	..	483	..	9	48	12	..	..	..
W.	,,	24	22,461	321	352	200	..	..	519	..	15	31	8	5,075	..	..
T.	,,	25	38,887	304	463	274	1,013		607	1	7	19	16	..	..	..
F.	,,	26	25,225	213	373	259	831	..	466	..	6	16	8	..	..	..
S.	,,	27	60,523	254	586	228	2,966	..	725	..	9	24	13	..	..	..
M.	,,	29	58,917	411	713	318	1,290	..	680	..	28	91	9	..	..	..
T.	,,	30	49,928	309	569	329	1,224	5	669	..	22	31	13	..	..	..
W.	,,	31	13,859	129	213	189	..	1	184	..	17	30	16	..	..	1,226
			2,722,900	74,953	100,144	39,950	135,918	326	27,976	6	949	1,810	415	57,447	743	1,226
Less Opening Day			20,000													
			2,702,900													
Variations in Days			151													
Total Official Return			2,703,051													

II. RETURN SHOWING

NUMBER OF VISITORS

DURING THE TERM OF THE

EXHIBITION.

Date.		Day of the Week.	Entrance Fee.		Cash Received at the Doors.			Number of Visitors during the Hours the Exhibition was open to the Public.								No. in the Building at 6 P.M.	Remarks.
			s.	d.	£	s.	d.	Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1s. each.	With (green) Paper Tickets at 2s. 6d. each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
May	14	Monday ..	1	0	1,580	5	1	29,894	7,698	2,310	..	2,900	139	42,941	..	..	Bank Holiday.
,,	15	Tuesday ..	1	0	1,053	14	1	20,971	5,955	700	..	164	1,656	29,446	..	..	
,,	16	Wednesday	2	6	859	1	6	6,771	848	874	377	..	328	9,198	..	..	
,,	17	Thursday	1	0	613	18	9	12,195	3,596	1,623	..	128	972	18,514	..	..	
,,	18	Friday ..	1	0	536	2	0	10,632	Included in Saturday's return.			149	Included in Saturday's Return.	16,200	..	..	
,,	19	Saturday ..	1	0	549	4	7	10,886	5,680	2,637	..	157	2,809	16,750	..	..	
		Totals for week			5,192	6	0	91,349	23,777	8,144	377	3,498	5,904	..	133,049	..	
,,	21	Monday ..	1	0	404	10	6	8,045	2,507	1,178	..	73	977	12,780	..	..	
,,	22	Tuesday ..	1	0	622	14	2	10,018	2,505	1,365	..	163	2,611	16,662	..	..	
,,	23	Wednesday	2	6	946	15	6	7,573	1,014	..	471	..	1,887	10,945	..	..	
,,	24	Thursday	1	0	507	14	6	10,077	3,308	1,300	..	131	1,210	16,026	..	..	
,,	25	Friday ..	1	0	355	13	6	7,039	2,275	900	..	116	1,178	11,508	..	..	
,,	26	Saturday	1	0	564	3	1	11,190	4,510	1,681	..	173	1,560	19,114	..	..	
		Totals for week			3,401	11	3	53,942	16,119	6,424	471	656	9,423	..	87,035	..	
		,, to last week			5,192	6	0	91,349	23,777	8,144	377	3,498	5,904	..	..	..	
		Totals since opening			8,593	17	3	145,291	39,896	14,568	848	4,154	15,327	..	220,084	.	
,,	28	Monday ..	1	0	349	1	6	6,933	2,184	1,051	..	82	970	11,220	..	..	
,,	29	Tuesday ..	1	0	395	9	0	7,845	2,598	1,014	..	114	886	12,457	..	..	
,,	30	Wednesday	2	6	597	0	0	4,773	694	..	372	..	1,355	7,194	..	..	
,,	31	Thursday	1	0	410	4	6	8,125	2,984	1,070	..	143	1,150	13,472	..	..	
June	1	Friday ..	1	0	345	5	6	6,849	1,979	1,295	..	96	1,195	11,414	..	..	
,,	2	Saturday ..	1	0	465	6	2	9,197	3,466	1,294	..	214	1,209	15,380	..	..	
		Totals for week			2,562	6	8	43,722	13,905	5,724	372	649	6,765	..	71,137	..	
		,, to last week			8,593	17	3	145,291	39,896	14,568	848	4,154	15,327	..	..	..	
		Totals since opening			11,156	3	11	189,013	53,801	20,292	1,220	4,803	22,092	..	291,221	..	

Date.	Day of the Week.	Entrance Fee.		Cash Received at the Doors.			NUMBER OF VISITORS DURING THE HOURS THE EXHIBITION WAS OPEN TO THE PUBLIC.								No. in the Building at 6 P.M.	REMARKS.
							Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1s. each.	With (green) Paper Tickets at 2s. 6d. each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s.	d.	£	s.	d.										
June 4	Monday ..	1	0	383	6	0	7,585	2,774	1,244	..	156	1,008	12,767	..	..	
,, 5	Tuesday ..	1	0	399	17	3	7,937	2,847	1,201	..	108	1,066	13,159	..	..	
,, 6	Wednesday	2	6	585	4	6	4,677	708	..	441	..	1,316	7,142	..	..	
,, 7	Thursday	1	0	395	2	6	7,821	3,206	1,243	..	142	946	13,358	..	..	
,, 8	Friday ..	1	0	357	4	4	7,035	2,236	426	..	196	1,558	11,451	..	..	
,, 9	Saturday ..	1	0	475	9	10	9,412	3,607	994	..	170	1,364	15,547	..	..	
	Totals for week			2,596	4	5	44,467	15,378	5,108	441	772	7,258	..	73,424	..	
	,, to last week			11,156	3	11	189,013	53,801	20,292	1,220	4,803	22,092	..	291,221	..	
	Totals since opening			13,752	8	4	233,480	69,179	25,400	1,661	5,575	29,350	..	364,645	..	
,, 11	Monday ..	1	0	403	10	10	8,002	3,407	960	..	110	1,212	13,691	..	..	
,, 12	Tuesday ..	1	0	432	19	2	8,532	3,466	1,006	..	222	1,299	14,525	..	..	
,, 13	Wednesday	2	6	532	19	5	4,247	615	..	264	19	1,266	6,411	..	..	
,, 14	Thursday	1	0	422	14	2	8,350	3,283	1,262	..	170	1,110	14,175	..	..	
,, 15	Friday ..	1	0	351	18	6	6,942	2,646	3,424	..	164	1,079	14,255	..	..	
,, 16	Saturday ..	1	0	501	19	6	9,897	4,603	2,382	..	200	1,412	18,494	..	..	
	Totals for week ..			2,646	1	7	45,970	18,020	9,034	264	885	7,378	..	81,551	..	
	,, to last week			13,752	8	4	233,480	69,179	25,400	1,661	5,575	29,350	..	..	..	
	Totals since opening			16,398	9	11	279,450	87,199	34,434	1,925	6,460	36,728	..	446,196	..	
,, 18	Monday ..	1	0	398	15	4	7,893	3,517	1,508	..	115	1,112	14,145	..	..	
,, 19	Tuesday ..	1	0	399	2	8	7,886	3,801	1,650	..	154	1,197	14,688	..	..	
,, 20	Wednesday	2	6	444	4	6	3,546	833	..	511	..	1,411	6,301	..	..	
,, 21	Thursday	1	0	376	0	10	7,377	3,882	1,576	..	253	1,109	14,197	..	..	
,, 22	Friday ..	1	0	325	12	4	6,428	2,849	1,925	..	136	939	12,277	..	..	
,, 23	Saturday ..	1	0	519	8	6	10,242	4,856	2,804	..	232	1,426	19,560	..	..	
	Totals for week ..			2,463	4	2	43,372	19,738	9,463	511	890	7,194	..	81,168	..	
	,, to last week			16,398	9	11	279,450	87,199	34,434	1,925	6,460	36,728	..	..	..	
	Totals since opening.			18,861	14	1	322,822	106,937	43,897	2,436	7,350	43,922	..	527,364	..	

Date.	Day of the Week.	Entrance Fee.		Cash Received at the Doors.			NUMBER OF VISITORS DURING THE HOURS THE EXHIBITION WAS OPEN TO THE PUBLIC.								No. in the Building at 6 P.M.	REMARKS.
							Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1s. each.	With (green) Paper Tickets at 2s. 6d. each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s.	d.	£	s.	d.										
June 25	Monday ..	1	0	335	6	6	6,658	3,568	1,772	..	93	740	12,831	..	..	
,, 26	Tuesday ..	1	0	401	16	6	7,303	3,782	1,383	..	166	1,779	14,413	..	..	
,, 27	Wednesday	2	6	435	10	0	3,484	826	..	568	..	1,321	6,199	..	..	Open until 10 P.M. from this date.
,, 28	Thursday	1	0	418	19	6	8,275	5,348	2,294	..	201	1,801	17,919	..	..	
,, 29	Friday ..	1	0	306	14	0	6,060	2,811	1,420	..	148	1,004	11,443	..	..	
,, 30	Saturday ..	1	0	485	0	0	9,593	5,104	3,567	..	206	1,214	19,684	..	..	
	Totals for week ..			2,383	6	6	41,373	21,439	10,436	568	814	7,859	..	82,489	..	
	„ to last week			18,861	14	1	322,822	106,937	43,897	2,436	7,350	43,922	..	527,364	..	
	Totals since opening			21,245	0	7	364,195	128,376	54,333	3,004	8,164	51,781	..	609,853	..	
July 2	Monday ..	1	0	306	14	6	6,050	3,239	1,335	..	159	837	11,620	..	..	
,, 3	Tuesday ..	1	0	461	19	0	7,302	3,365	1,032	..	195	3,136	15,030	..	12,811	
,, 4	Wednesday	2	6	360	18	9	2,872	653	..	394	31	1,293	5,243	..	..	
,, 5	Thursday	1	0	410	10	0	8,082	3,855	1,366	..	252	1,261	14,816	..	..	
,, 6	Friday ..	1	0	325	17	0	[illegible]	2,602	1,162	..	408	1,201	11,684	..	9,342	
,, 7	Saturday	1	0	513	18	6	10,156	5,845	2,202	..	233	1,696	20,132	..	16,366	
	Totals for week ..			2,379	17	9	40,773	19,559	7,097	394	1,278	9,424	..	78,525	..	
	„ to last week			21,245	0	7	364,195	128,376	54,333	3,004	8,164	51,781	..	..	..	
	Totals since opening			23,624	18	4	404,968	147,935	61,430	3,398	9,442	61,205	..	688,378	..	
,, 9	Monday ..	1	0	444	18	6	8,773	4,400	1,411	..	243	1,200	16,027	..	13,219	
,, 10	Tuesday ..	1	0	554	4	0	10,912	5,900	2,211	..	338	1,274	20,635	..	16,483	
,, 11	Wednesday	2	6	467	18	9	3,727	1,294	..	448	33	1,272	6,774	..	5,295	
,, 12	Thursday	1	0	437	10	0	8,611	4,332	1,525	..	278	1,140	15,886	..	12,613	
,, 13	Friday ..	1	0	414	5	0	8,013	3,301	975	..	532	1,113	13,934	..	10,465	
,, 14	Saturday ..	1	0	520	8	0	10,281	6,519	2,486	..	240	1,393	20,919	..	15,927	
	Totals for week ..			2,839	4	3	50,317	25,746	8,608	448	1,664	7,392	..	94,175	..	
	„ to last week			23,624	18	4	404,968	147,935	61,430	3,398	9,442	61,205	..	..	..	
	Totals since opening			26,464	2	7	455,285	173,681	70,038	3,846	11,106	68,597	..	782,553	..	

Date.	Day of the Week.	Entrance Fee.		Cash Received at the Doors.			NUMBER OF VISITORS DURING THE HOURS THE EXHIBITION WAS OPEN TO THE PUBLIC.								No. in the Building at 6 P.M.	REMARKS.
							Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1*s.* each.	With (green) Paper Tickets at 2*s.* 6*d.* each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s.	*d.*	£	*s.*	*d.*										
July 16	Monday ..	1	0	432	8	6	8,435	4,715	2,356	..	421	1,099	17,026	..	13,910	
,, 17	Tuesday ..	1	0	444	17	6	8,728	4,752	2,292	..	329	1,608	17,709	..	13,690	
,, 18	Wednesday	2	6	204	12	6	1,637	385	..	171	..	790	2,983	..	..	Closed at 5 P.M. Royal Fête.
,, 19	Thursday	1	0	525	12	0	10,340	5,503	1,782	..	320	1,219	19,164	..	14,728	
,, 20	Friday ..	1	0	342	16	6	6,619	3,456	1,132	..	467	697	12,371	..	10,024	
,, 21	Saturday ..	1	0	564	0	0	11,049	7,641	2,456	..	452	1,460	23,058	..	17,525	
	Totals for week ..			2,514	7	0	46,808	26,452	10,018	171	1,989	6,873	..	92,311	..	
	„ to last week			26,464	2	7	455,285	173,681	70,038	3,846	11,106	68,597	..	782,553	..	
	Totals since opening			28,978	9	7	502,093	200,133	80,056	4,017	13,095	75,470	..	874,864	..	
,, 23	Monday ..	1	0	444	18	0	8,699	5,203	2,083	..	388	1,101	17,474	..	14,266	
,, 24	Tuesday ..	1	0	577	7	6	10,864	5,885	1,966	..	283	1,994	20,992	..	16,131	
,, 25	Wednesday	2	6	237	0	0	1,896	415	..	170	..	674	3,155	..	..	Closed at 5 P.M. Society of Arts Conversazione.
,, 26	Thursday	1	0	557	9	6	10,937	6,042	2,235	..	319	1,573	21,106	..	15,314	
,, 27	Friday ..	1	0	402	16	6	7,942	4,058	1,387	..	227	1,242	14,856	..	10,650	
,, 28	Saturday ..	1	0	681	13	6	13,481	8,526	2,405	..	291	1,648	26,351	..	18,653	
	Totals for week ..			2,901	5	0	53,819	30,129	10,076	170	1,508	8,232	..	103,934	..	
	„ to last week			28,978	9	7	502,093	200,133	80,056	4,017	13,095	75,470	..	..	..	
	Totals since opening			31,879	14	7	555,912	230,262	90,132	4,187	14,603	83,702	..	978,798	..	
,, 30	Monday ..	1	0	441	14	0	8,740	5,473	1,813	..	188	1,139	17,353	..	13,436	
,, 31	Tuesday ..	1	0	499	1	0	9,817	5,874	2,110	..	324	1,253	19,378	..	15,135	
Aug. 1	Wednesday	2	6	614	5	0	4,913	773	..	406	..	2,039	8,131	..	4,192	
,, 2	Thursday	1	0	574	12	6	11,209	7,431	2,188	..	563	1,295	22,686	..	16,575	
,, 3	Friday ..	1	0	478	19	0	9,465	4,738	1,472	..	228	1,205	17,108	..	12,093	
,, 4	Saturday	1	0	572	6	0	11.349	6,916	2,319	..	194	1,214	21,992	..	16,815	
	Totals for week ..			3,180	17	6	55,493	31,205	9,902	406	1,497	8,145	..	106,648	..	
	„ to last week			31,879	14	7	555,912	230,262	90,132	4,187	14,603	83,702	..	..	..	
	Totals since opening			35,060	12	1	611,405	261,467	100,034	4,593	16,100	91,847	..	1,085,446	..	

Date.		Day of the Week.	Entrance Fee.		Cash Received at the Doors.			Number of Visitors during the Hours the Exhibition was open to the Public.								No. in the Building at 6 P.M.	Remarks.
								Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1*s.* each.	With (green) Paper Tickets at 2*s.* 6*d.* each.	Children and Half-price Admissions.	With Season Tickets	Total each Day.	Total to end of Week.		
			s.	*d.*	£	*s.*	*d.*										
Aug.	6	Monday ..	1	0	1,374	14	0	27,298	20,865	5,566	..	314	1,825	55,868	..	50,617	Bank Holiday.
,,	7	Tuesday ..	1	0	734	8	6	14,580	11,267	3,155	..	172	1,591	30,765	..	26,855	
,,	8	Wednesday	2	6	424	12	6	3,397	879	..	366	..	1,955	6,597	..	4,713	
,,	9	Thursday	1	0	518	1	0	10,222	7,765	2,370	..	272	1,335	21,964	..	18,059	
,,	10	Friday ..	1	0	374	13	6	7,418	5,404	1,677	..	151	1,129	15,779	..	12,613	
,,	11	Saturday	1	0	488	12	0	9,687	7,303	1,679	..	170	1,655	20,494	..	14,120	
		Totals for week			3,915	1	6	72,602	53,483	14,447	366	1,079	9,490	..	151,467	..	
		,, to last week			35,060	12	1	611,405	261,467	100,034	4,593	16,100	91,847	..	1,085,446	..	
		Totals since opening			38,975	13	7	684,007	314,950	114,481	4,959	17,179	101,337	..	1,236,913	..	
,,	13	Monday ..	1	0	473	12	6	9,417	6,992	2,754	..	111	1,228	20,502	..	17,076	
,,	14	Tuesday ..	1	0	452	18	6	8,893	7,226	2,005	..	331	1,163	19,618	..	15,808	
,,	15	Wednesday	2	6	479	5	0	3,824	1,131	..	331	20	1,886	7,192	..	4,035	
,,	16	Thursday	1	0	475	6	6	9,349	7,963	1,894	..	315	902	20,423	..	16,071	
,,	17	Friday ..	1	0	295	5	0	5,864	4,705	1,247	..	80	1,026	12,922	..	10,060	
,,	18	Saturday ..	1	0	471	14	6	9,324	7,545	1,674	..	221	1,389	20,153	..	14,661	
		Totals for week ..			2,648	2	0	46,671	35,562	9,574	331	1,078	7,594	..	100,810	..	
		,, to last week			38,975	13	7	684,007	314,950	114,481	4,959	17,179	101,337	..	..	..	
		Totals since opening			41,623	15	7	730,678	350,512	124,055	5,290	18,257	108,931	..	1,337,723	..	
,,	20	Monday ..	1	0	495	15	6	9,791	7,122	2,657	..	249	1,043	20,862	..	17,425	
,,	21	Tuesday ..	1	0	468	11	3	9,257	7,738	2,200	..	228	942	20,365	..	16,412	
,,	22	Wednesday	2	6	527	2	6	4,217	1,250	..	322	..	2,021	7,810	..	3,834	
,,	23	Thursday	1	0	478	15	6	9,508	7,976	2,004	..	135	1,331	20,954	..	16,178	
,,	24	Friday ..	1	0	332	17	0	6,611	4,738	1,169	..	92	1,128	13,738	..	10,352	
,,	25	Saturday ..	1	0	525	9	0	10,443	8,564	2,661	..	126	1,369	23,163	..	17,639	
		Totals for week ..			2,828	10	9	49,827	37,388	10,691	322	830	7,834	..	106,892	..	
		,, to last week			41,623	15	7	730,678	350,512	124,055	5,290	18,257	108,931	..	..	..	
		Totals since opening			44,452	6	4	780,505	387,900	134,746	5,612	19,087	116,765	..	1,444,615	..	

Date.	Day of the Week.	Entrance Fee.	Cash Received at the Doors.	Number of Visitors during the Hours the Exhibition was open to the Public.								No. in the Building at 6 P.M.	Remarks.
				Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1*s.* each.	With (green) Paper Tickets at 2*s.* 6*d.* each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s. *d.*	£ *s.* *d.*										
Aug. 27	Monday ..	1 0	419 18 0	8,341	7,001	2,122	..	114	1,223	18,801	..	15,668	
,, 28	Tuesday ..	1 0	488 2 0	9,717	8,112	2,671	..	90	1,257	21,847	..	18,084	
,, 29	Wednesday	2 6	581 2 6	4,649	1,249	..	388	..	2,146	8,432	..	3,784	
,, 30	Thursday	1 0	429 0 6	8,509	7,655	2,038	..	143	1,237	19,582	..	15,754	
,, 31	Friday ..	1 0	227 11 6	4,532	4,006	1,112	..	39	933	10,622	..	8,831	
Sept. 1	Saturday	1 0	665 5 6	13,176	14,260	2,903	..	241	2,237	32,817	..	22,727	
	Totals for week ..		2,811 0 0	48,924	42,283	10,846	388	627	9,033	..	112,101	..	
	„ to last week		44,452 6 4	780,505	387,900	134,746	5,612	19,087	116,765	..	1,444,615	..	
	Totals since opening		47,263 6 4	829,429	430,183	145,592	6,000	19,714	125,798	..	1,556,716	..	
,, 3	Monday ..	1 0	399 5 0	7,934	7,329	1,977	..	102	1,017	18,359	..	15,664	
,, 4	Tuesday ..	1 0	424 13 0	8,391	8,243	2,417	..	198	1,164	20,413	..	17,269	
,, 5	Wednesday	2 6	425 2 6	3,401	1,184	..	352	..	1,874	6,811	..	3,525	
,, 6	Thursday	1 0	396 3 6	7,881	7,601	2,383	..	83	1,078	19,026	..	15,750	
,, 7	Friday ..	1 0	289 17 0	5,756	4,694	1,256	..	82	1,220	13,008	..	10,588	
,, 8	Saturday ..	1 0	644 0 6	12,720	14,140	2,885	..	313	2,005	32,063	..	19,194	
	Totals for week ..		2,579 1 6	46,083	43,191	10,918	352	778	8,358	..	109,680	..	
	„ to last week		47,263 6 4	829,429	430,183	145,592	6,000	19,714	125,798	..	..	..	
	Totals since opening		49,842 7 10	875,512	473,374	156,510	6,352	20,492	134,156	..	1,666,396	..	
,, 10	Monday ..	1 0	329 2 6	6,520	7,919	2,025	..	125	941	17,530	..	15,768	
,, 11	Tuesday ..	1 0	303 5 6	6,036	6,571	1,839	..	59	1,170	15,675	..	13,808	
,, 12	Wednesday	2 6	480 8 9	3,830	1,381	..	398	25	1,913	7,547	..	4,062	
,, 13	Thursday	1 0	411 0 6	8,157	8,210	1,821	..	119	1,219	19,526	..	15,642	
,, 14	Friday ..	1 0	279 19 6	5,524	5,037	1,046	..	149	1,083	12,839	..	10,251	
,, 15	Saturday	1 0	767 11 6	15,272	16,608	3,687	..	159	2,015	37,741	..	23,869	
	Totals for week ..		2,571 8 3	45,339	45,726	10,418	398	636	8,341	..	110,858	..	
	„ to last week		49,842 7 10	875,512	473,374	156,510	6,352	20,492	134,156	..	..	..	
	Totals since opening		52,413 16 1	920,851	519,100	166,928	6,750	21,128	142,497	..	1,777,254	..	

Date.	Day of the Week.	Entrance Fee.	Cash Received at the Doors.	NUMBER OF VISITORS DURING THE HOURS THE EXHIBITION WAS OPEN TO THE PUBLIC.								No. in the Building at 6 P.M.	REMARKS.
				Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1*s.* each.	With (green) Paper Tickets at 2*s.* 6*d.* each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s. *d.*	£ *s.* *d.*										
Sept. 17	Monday ..	1 0	449 7 6	8,944	9,113	2,450	..	81	1,077	21,665	..	18,256	
,, 18	Tuesday ..	1 0	416 9 0	8,219	8,313	2,174	..	216	1,229	20,151	..	16,541	
,, 19	Wednesday	2 6	650 10 0	5,204	1,925	..	511	..	2,193	9,833	..	4,719	
,, 20	Thursday	1 0	321 19 0	6,400	7,004	1,754	..	78	1,174	16,410	..	13,105	
,, 21	Friday ..	1 0	214 15 6	4,180	4,076	1,123	..	231	961	10,571	..	8,392	
,, 22	Saturday ..	1 0	716 17 0	14,173	16,568	4,658	..	236	2,129	37,764	..	27,577	
	Totals for week ..		2,769 18 0	47,120	46,999	12,159	511	842	8,763	..	116,394	..	
	,, to last week		52,413 16 1	920,851	519,100	166,928	6,750	21,128	142,497	..	1,777,254	..	
	Totals since opening		55,183 14 1	967,971	566,099	179,087	7,261	21,970	151,260	..	1,893,648	..	
,, 24	Monday ..	1 0	302 5 6	5,982	7,244	2,188	..	127	1,005	16,546	..	14,299	
,, 25	Tuesday ..	1 0	333 19 6	6,593	7,619	1,853	..	173	1,132	17,370	..	14,277	
,, 26	Wednesday	2 6	469 11 3	3,753	1,526	..	473	7	2,010	7,769	..	3,863	
,, 27	Thursday	1 0	278 6 0	5,542	6,776	1,675	..	48	855	14,896	..	12,106	
,, 28	Friday ..	1 0	206 4 6	4,009	3,395	805	..	231	995	9,435	..	7,424	
,, 29	Saturday ..	1 0	400 6 0	7,956	13,341	2,663	..	100	1,426	25,486	..	21,612	
	Totals for week ..		1,990 12 9	33,835	39,901	9,184	473	686	7,423	..	91,502	..	
	,, to last week		55,183 14 1	967,971	566,099	179,087	7,261	21,970	151,260	..	..	..	
	Totals since opening		57,174 6 10	1,001,806	606,000	188,271	7,734	22,656	158,683	..	1,985,150	..	
Oct. 1	Monday ..	1 0	345 4 6	6,892	7,578	2,050	..	25	1,065	17,610	..	14,869	
,, 2	Tuesday ..	1 0	329 13 6	6,547	7,471	1,683	..	93	1,165	16,959	..	14,252	
,, 3	Wednesday	2 6	302 10 0	2,420	992	..	412	..	1,377	5,201	..	3,147	
,, 4	Thursday	1 0	211 12 0	4,172	5,242	1,458	..	118	1,107	12,097	..	9,661	
,, 5	Friday ..	1 0	182 16 6	3,649	3,385	1,003	..	15	964	9,016	..	7,683	
,, 6	Saturday ..	1 0	628 11 0	12,414	16,149	2,919	..	274	2,025	33,781	..	22,181	
	Totals for week ..		2,000 7 6	36,094	40,817	9,113	412	525	7,703	..	94,664	..	
	,, to last week		57,174 6 10	1,001,806	606,000	188,271	7,734	22,656	158,683	..	..	..	
	Totals since opening		59,174 14 4	1,037,900	646,817	197,384	8,146	23,181	166,386	..	2,079,814	..	

Date.	Day of the Week.	Entrance Fee.		Cash Received at the Doors.			Number of Visitors during the Hours the Exhibition was open to the Public.								No. in the Building at 6 P.M.	Remarks.
							Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1*s.* each.	With (green) Paper Tickets at 2*s.* 6*d.* each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s.	*d.*	£	*s.*	*d.*										
Oct. 8	Monday ..	1	0	278	8	6	5,555	7,787	1,497	..	27	1,831	16,697	..	14,344	
,, 9	Tuesday ..	1	0	284	1	6	5,614	6,602	1,389	..	125	1,442	15,172	..	12,667	
,, 10	Wednesday	2	6	439	3	9	3,510	2,131	..	949	5	2,123	8,718	..	5,617	
,, 11	Thursday	1	0	349	16	0	6,943	8,698	1,741	..	100	1,193	18,675	..	15,159	
,, 12	Friday ..	1	0	226	5	6	4,494	4,344	886	..	63	1,245	11,032	..	8,946	
,, 13	Saturday	1	0	837	1	6	16,414	28,722	4,000	..	204	2,633	51,973	..	36,227	
	Totals for week ..			2,414	16	9	42,530	58,284	9,513	949	524	10,467	..	122,267	..	
	„ to last week			59,174	14	4	1,037,900	646,817	197,384	8,146	23,181	166,386	..	2,079,814	..	
	Totals since opening			61,589	11	1	1,080,430	705,101	206,897	9,095	23,705	176,853	..	2,202,081	..	
,, 15	Monday ..	1	0	451	13	6	8,740	15,995	2,730	..	587	987	29,039	..	25,370	
,, 16	Tuesday ..	1	0	368	19	6	7,020	16,410	1,806	..	719	1,822	27,777	..	24,472	
,, 17	Wednesday	2	6	552	9	9	4,326	2,447	..	290	187	2,935	10,185	..	6,667	
,, 18	Thursday	1	0	418	2	6	7,872	16,178	2,106	..	981	1,504	28,641	..	23,801	
,, 19	Friday ..	1	0	196	19	6	3,640	7,549	1,104	..	597	1,208	14,098	..	12,415	
,, 20	Saturday ..	1	0	787	2	6	14,721	32,824	4,644	..	1,990	2,243	56,422	..	42,273	
	Totals for week ..			2,775	7	3	46,319	91,403	12,390	290	5,061	10,699	..	166,162	..	
	„ to last week			61,589	11	1	1,080,430	705,101	206,897	9,095	23,705	176,853	..	..	..	
	Totals since opening			64,364	18	4	1,126,749	796,504	219,287	9,385	28,766	187,552	..	2,368,243	..	
,, 22	Monday ..	1	0	455	17	0	8,560	20,648	2,626	..	1,104	1,475	34,413	..	31,288	
,, 23	Tuesday ..	1	0	375	6	6	6,844	18,540	2,075	..	1,325	1,811	30,595	..	26,775	
,, 24	Wednesday	2	6	809	9	3	6,302	10,656	..	1,344	347	3,812	22,461	..	18,096	
,, 25	Thursday	1	0	520	10	0	9,572	23,284	3,180	..	1,676	1,175	38,887	..	32,998	
,, 26	Friday ..	1	0	384	13	6	6,854	12,694	1,974	..	1,679	2,024	25,225	..	20,941	
,, 27	Saturday	1	0	897	1	0	16,620	32,717	5,048	..	2,593	3,545	60,523	..	44,607	
	Totals for week ..			3,442	17	3	54,752	118,539	14,903	1,344	8,724	13,842	..	212,104	..	
	„ to last week			64,364	18	4	1,126,749	796,504	219,287	9,385	28,766	187,552	..	..	..	
	Totals since opening			67,807	15	7	1,181,501	915,043	234,190	10,729	37,490	201,394	..	2,580,347	..	

Date.	Day of the Week.	Entrance Fee.	Cash Received at the Doors.	Number of Visitors during the Hours the Exhibition was open to the Public.								No. in the Building at 6 P.M.	Remarks.
				Paying at the Doors.	With Railway Tickets.	With (buff) Paper Tickets at 1s. each.	With (green) Paper Tickets at 2s. 6d. each.	Children and Half-price Admissions.	With Season Tickets.	Total each Day.	Total to end of Week.		
		s. d.	£ s. d.										
Oct. 29	Monday ..	1 0	946 11 0	17,348	29,647	5,806	..	3,102	3,014	58,917	..	50,782	
,, 30	Tuesday ..	1 0	752 3 0	13,755	27,282	4,085	..	2,528	2,278	49,928	..	40,796	
,, 31	Wednesday	2 6	837 6 3	6,611	none issued.	..	1,121	175	5,952	13,859	..	9,322	
	Totals for 3 days		2,536 0 3	37,714	56,929	9,891	1,121	5,805	11,244	..	122,704	..	
	,, to last week		67,807 15 7	1,181,501	915,043	234,190	10,729	37,490	201,394	..	2,580,347	..	
	Totals since opening		70,343 15 10	1,219,215	971,972	244,081	11,850	43,295	212,638	..	2,703,051	..	
Average per day since opening			£478 10 7	8,294	6,612	1,660	80	295	1,446	18,387	..	..	

Cash received at the doors.—A difference will, in many cases, be found to exist between the amount of cash shown under this heading and the numbers given as payments at the doors and half-price admissions, which is explained by the fact that the amounts given are the amounts actually paid into the bank. On days when the number has been very great, it has often happened that the amount of cash actually taken has been in excess of that registered. From the 6th to 23rd June there was a charge of 2*d.* each for admission to the Fish Market, and again on 22nd May, 26th June, and the 3rd and 24th July an extra charge of 2*s.* 6*d.* was made for admission to the Royal Horticultural Society's Shows: although the extra amounts taken on all these occasions are included in the amounts under the above heading the numbers could not be shown as either full or half-priced admissions.

Season Tickets.—Besides the ordinary Season Tickets, Royal Horticultural Society Tickets, Exhibitors and Assistants' Passes, Complimentary, and All Free Admissions are included in these numbers.

J. Douglas Dick,

Superintendent of Entrances.

CONDENSED REPORTS ON THE CONDITION OF THE FISHERY INDUSTRY IN THE UNITED KINGDOM AND ABROAD, USED IN THE FIRST INSTANCE IN THE OFFICIAL CATALOGUE.

PREPARED BY INVITATION OF THE EXECUTIVE COMMITTEE.

CONDENSED REPORTS

REFERRING TO THE

FISHING INDUSTRY

AT HOME AND ABROAD.

THE FISHERIES OF GREAT BRITAIN.

UNDER this head is included everything immediately relating to and connected with the actual working of all kinds of fishing. The class has been naturally and conveniently divided into two sections—sea fishing and freshwater fishing; and it is to the more important section of sea fishing that attention will first be directed.

SEA FISHING.

The wide importance of the sea fisheries will be perhaps better understood when the variety of objects now brought together before the public have been examined, and it is observed how many trades must be kept at work, and how much knowledge in various forms is required to provide the fisherman with the apparently simple means of carrying on his daily occupation of catching fish. The demand for sea fish is constantly increasing. This naturally leads to greater enterprise among the fishermen; and capital, in the majority of cases the accumulated savings from years of hard work at the fisheries, is invested in additional boats and gear for the further development of an industry which, laborious as it is, yet rarely fails to bring a more or less profitable return to all who are concerned in it. The special increase of fishing during recent years has been, however, in the deep sea, and nothing has been more remarkable in this respect than the rapid growth of beam-trawling, especially in the North Sea, where a great extent of suitable ground is always available. It is from this vast field and by the method of fishing known as "beam-trawling" that the London and country markets are mainly supplied with turbot, brill, and soles among "prime" fish, and thousands of tons of plaice, haddock, and other common fish are obtained and distributed at low prices among the poorer classes throughout the country. The peculiar construction of the beam-trawl will well repay examination, and some idea will be obtained of the manner in which such large numbers of fish are taken whilst the net is being silently towed over the ground, entirely out of sight of the fishermen.

Second only in importance to the trawl is the drift-net, the method by which mackerel, herrings, and pilchards are principally captured. In this case we have nets which are in general use all round our coasts, and employed at long as well as at moderate distances from the land. As their name implies, "drift-nets" require plenty of room, for they are carried wherever the tide may drift them during the few hours they are left in the water; and their simple character will be readily understood from the numerous specimens exhibited, differing but little in general appearance except in the size of the mesh, which is adapted to the kind of fish intended to be taken. Few people who are not fishermen have any idea of the hundreds or even thousands of miles of net which almost nightly in the regular fishing seasons float like long walls or barriers in the sea to intercept and mesh the shoals of fish as they gradually draw in towards the coast. The drift fisheries are altogether a very important industry, both to ourselves and those countries bordering in the North Sea and the Channel, and in Scotland the drift herring fishery is looked forward to as the most valuable harvest. Besides the nets already mentioned, many other varieties will be found abundantly represented; among them the gigantic funnel-shaped stow-net, by which thousands of tons of sprats are caught every winter at the mouth of the Thames and other places on the south coast of England, and the sean, seine, or sweep-net (the ancient *Sagena*) the oldest form of net of which we have any distinct record. More universal in its use than nets, and of particular importance for the capture of certain kinds of fish, line fishing must always possess a great deal of interest. It represents probably the earliest method of fishing, and fish hooks of some description, and often of the roughest kind, have been found in use among the most uncivilized people met with by early navigators. Line fishing in this country is extensively carried on for the capture especially of cod, ling, haddock and whiting, and hooked fish of these kinds usually command a higher price than those caught in the trawl, as their delicacy is not impaired by the knocking about to which they are subjected when massed together among the varied and often crowded contents of the beam-trawl. The various plans adopted in different countries for fitting out the special gear for the capture of particular kinds of fish both by hand-line and long line are well represented, and no doubt may be studied with advantage.

Objects of special interest will be found in the numerous models of, and designs for, the boats and vessels in which the fisheries are carried on. The increasing tendency in recent times to fish at long distances from the land and to remain at sea for even many weeks at a time, has led to a marked change in the character of the fishing vessels employed, and has induced builders to study the advantages of greater size and improved designs in the construction of vessels capable of facing the bad weather to which they are sure sooner or later to be exposed. Even in the smaller boats more commonly employed in drift fishing, the advantage of their being decked is daily becoming more evident; for they can stand worse weather, and therefore can risk going farther to sea, and seeking the shoals of fish where formerly they dared not venture. The most important improvement, however, in connection with fishing craft is the employment of steam power; and it is applied in various ways, although the additional expense incurred interfered for some time with even its present partial adoption. Its advantage, however, is very great, enabling the fishing boats to go to and return quickly from their fishing grounds, saving both time and labour in hauling their nets, and especially in the case of deep-sea trawling, where fast steam "carriers" collect the fish from a fleet of trawlers, and make the best of their way with it to the nearest market; so that whether used as a partial substitute for sails, for economising labour on board ship, or securing a quick delivery of the fish at the market, the application of steam to fishing vessels must be regarded as one of the most important steps yet taken in the development of the deep-sea fisheries. The sea-going character of so many of our fishing vessels obliges them also to be fitted out with more elaborate appliances than were ever thought of by the simple-minded fishermen of little more than a generation back. They have now to deal with everything on a larger scale, and they find the benefit of numerous inventions and recent improvements in capstans, compasses, lights, barometers, &c., helping them to do their work more easily, and to take better precautions against the many dangers to which they are exposed in the stormy weather they have so frequently to contend with.

The dangers to which fishermen are so often subjected when at sea are, however, not the only ones they have to deal with, and on many exposed parts of the coast their greatest difficulty frequently meets them on their return home, when they have perhaps to run before the gale for the narrow entrance of the little fishing harbour which is the only protection they have for their boats. Sad tales of distress might be told, of boats being dashed to pieces against the piers in attempting to enter some of the little harbours on the Scotch coast, or, having failed to properly make the entrance, are helplessly driven on the neighbouring rocks, and perish within sight of their homes. Models of suitable artificial harbours for fishing-boats therefore deserve the best attention, and in connection with this subject some proposed methods for breaking the force of the sea at the entrance to harbours may be examined with interest.

Life-boats and life-saving apparatus will probably appear to many people to have but little to do with sea-fishing ; but unfortunately such is not the case. The large scale on which the deep-sea fisheries are now carried on, and the boat work necessary for conveying the fish from the trawlers to the carriers in all kinds of weather, open a wide field for the use of life-belts, and the adaptation of some of the principles on which life boats are constructed to the small boats belonging to the fishing vessel. Fishermen are, however, very careless of danger, and like sailors in general are disposed to regard simple precautions for safety as implying a doubt of their courage and hardihood. The winter storms, however, rarely pass over without the fishermen finding the advantage of the life-boat system which has been so admirably organised around our coasts. The splendid display of life-boats and life-saving apparatus bears strong testimony to the wide interest now felt at home and abroad in this important subject. Finally, some attention is being given to the means of communicating from the shore to light ships, or possibly to stations for fishing vessels, by submarine cables or methods of signalling; and a slight consideration of the variety of objects now brought under notice will show how many interests are concerned in the practical working of the sea-fisheries, and in procuring the large supply of wholesome food which is daily brought in from them to the markets.

E. W. H. HOLDSWORTH.

FRESHWATER FISHING.

THE origin of the art of angling is lost in the mist of ages. There is ample testimony to show that even fly-fishing with an imitation of the natural fly was practised more than 2000 years ago. Ælian mentions the fact, and accurately describes the trout in the river Astreus taking a natural fly called Hippurus, and how the natives of Macedonia constructed an imitation with a body of purple wool and with "wings of a waxy colour," which they dropped down the stream and which was seized by the fish. But the art of angling was far older than this, as the carvings on ancient Egyptian monuments amply testify. The Chinese and Japanese have been anglers for ages. The artificial flies of the Japanese would attract the curious attention of British anglers in the present day. The first author of whom we have any note in this country, who described "the art of Fyshynge with an angle," was Dame Juliana Berners, Prioress of Sopwell Nunnery in Hertfordshire, who wrote and published the Book of St. Albans in 1486. The first edition, printed by the schoolmaster printer of St. Albans, did not contain the treatise on angling, but the second, "Enprynted at Westmestre by Wynkyn the Worde in the yere of thyncarnacön of our lorde mcccclxxxxvi" contained the treatise of fishing. Angling in those days was by no means so common a practice as it is now, as may be gathered from the reason given by the worthy prioress for including this pamphlet in the much larger publication, as she puts it, "bycause that this preseant treatyse sholde not come to the handys of eche ydle persone whyche wolde desire it yf it were enprynted allone by itself and put in a lytyle plaunflett, therefore I have compylyd it in a greter volume of dyverse bokys concernynge to gentyll and noble men to the entent that the forsayd ydle persones whyche sholde have but lytyle mesure in the sayd dysporte of fysshing sholde not by this meane utterly dystroye it." Probably for this reason the number of authors who followed Dame Juliana for the next 200 years or so were very limited. In 1653 Isaak Walton wrote his delightful pastoral, which even at the present day is devoured with pleasure not only by anglers but by all lovers of country life and scenes. For another 200 years or so the number of works on angling came out but slowly, though far more rapidly than in the previous time. In 1811 one of the best known lists of angling works was published by G. W. H. Ellis; it numbered eighty works. Since then, however, the increase has been most rapid, and during the last fifteen or twenty years, work after work has poured out of the press, until in the present year of 1883 we read in the new edition of the Bibliotheca Piscatoria, published by Messrs. Westwood and Satchell lately, that no less than 3158 editions and reprints of 2148 distinct works are given and described in their catalogue. Tackle in the far-off times was of the rudest; a taper reed for a rod, some twisted horsehairs for a line, and a hook more remarkable for power than finish, which is not surprising when we find that amateur hook-making was generally practised in those days. And even in books not much more than 100 years old, minute directions were given as to the manufacture of hooks. But the increase of the literature is symptomatic of the increase in the practice of angling, and if the noble and gentle Dame Juliana could only come out of Sopwell Priory to the not far distant banks of the Lea, and see the class of people who throng its banks on any and every holiday to indulge in the gentle "dysporte of fysshynge with an angle," she would indeed be filled with amazement. For the sport of angling is now not only the sport of the select few, but of the many; it is a beneficent, health-giving pursuit, good both for the body and mind of the toiling thousands or even millions who throng the back streets of our larger cities, and who have no other inducement to leave their unhealthy habitations for the fresh air of the country. From this point of view (and it is a national point) the art of angling is a powerful lever for good if properly worked and exercised. Fifty years ago the London angler was derided as the Cockney fisherman, and jokes innumerable were cut upon his skill, his rod and his tackle; all this is changed, the fishermen and the tackle now sent forth from the great Metropolis are alike of the first excellence. Yearly, at the annual holiday, mighty fishers—peers, members of Parliament, professional men, hard worked men of business, rush off to Norway or Canada, the Highlands of Scotland, Wales, and Ireland, and by the banks of murmuring stream or thundering torrent recuperate brain, muscle and nerve power, in the absorbing pursuit after trout or salmon, returning after a six weeks' interregnum renewed and invigorated, and prepared to encounter anew the toil and exigencies of modern life and labour. That all the items required for the practice of their art should be constantly improved upon, and brought to the most excellent and handy make and fashion, is a matter of course. Rods, reels and lines, though admirable enough to meet all requirements in days gone by, are undoubtedly both better made and better suited to modern needs now, if the same amount of care is bestowed on their manufacture which was wont to be given to them formerly. That much inferior tackle is also turned out, owing to the mania for cheapness, is undoubted. Manufacturers, to meet this desire, set up all sorts of clever time and labour saving machinery, and turn out rods by the score where they could only turn out units by hand. But the careful inspection and the thorough test so requisite in the case of a really good article, cannot be and is not given ; and though it is quite probable that by accident you may get a fairly good thing cheaply, it is equally so that you may find your purchase dear at any price. If an angler desires tackle which he can trust in, he should go to the best makers and pay the best price for it. Nets and other apparatus for fishing for salmon and other fish in fresh water have been so improved that the only fear is that they may become too perfect for the prosperity of the fisheries ; while the improvements in waterproof clothing, boats, and all other fishing requisites can better be seen than described. All countries have contributed to send us the best they can produce in all these matters, and the choice we now have is truly vast and varied.

FRANCIS FRANCIS.
Angling Editor of the "Field" and late Naturalist Director of the Brighton Aquarium.

ECONOMIC CONDITION OF FISHERMEN.

WHILST the primary object of all International Industrial Exhibitions has ever been the advancement of Art, Industry and Commerce, they have not the less contributed to exhibit the wonderful resources of human genius, skill and labour. With the present advanced state of the division of labour, it is difficult, in many cases, to trace the workmanship of any piece of work direct to the labourer himself. Hence the most exquisite specimens of mechanical or hand industry are often only known by the names of the manufacturers or producers who happen to exhibit them. But in a Fishery Exhibition there is not the same difficulty in identifying the part which the labourer has taken in the articles exhibited, and we are thereby brought in direct contact with the fisherman himself.

It may not be easy to give material illustration of the economic condition of fishermen, nevertheless, we shall find it to a large extent reflected in the condition of the industry. If we see any fishery in the main carried on in little boats, owned by the fishermen themselves, in the same manner as the old handlooms in the silk industry, with more hands therein employed than would be required with due regard to economy, with antiquated or insufficient appliances, and using no other power than the wind, evidencing, in fact, on all sides want of capital and ingenuity, it is easy to conclude that the economic condition of the fishing population is unsatisfactory. If we see any fishery carried on in large and strong boats, worked on a large scale, with the most modern and effective gear and nets, using steam-power and attracting large capital, we may safely gather from it that the economic condition of the fishermen and all connected with the industry is likewise good.

The fishing industry is allied to agriculture in so far as it is directed to gathering the spontaneous products of nature and placing it within reach of consumption and commerce. But it is also a manufacturing industry in all that regards drying, salting, curing, kippering, smoking, &c., and thereby subject to the factory laws. There is a wide difference in the condition of the industry between river fisheries, and deep sea fisheries such as the herring, the cod, the pilchard, the whale, the oyster, and many others. In all cases, however, the fishing industry is fitful and irregular in times and seasons, and subject to great alternations of pressure, with long intervals of idleness, a circumstance which deeply affects the economic condition of the workers. In some localities the fisherfolk follow the fish; when the fishing is ended in one locality, they proceed to another. In other localities the fisherfolk alternate fishing and agricultural labour; and in others, when fishing is ended, the fishermen engage as sailors. But in all cases the occupation is of a most intermittent character, inconsistent with persistent labour, and well fitted to encourage lassitude and laziness. The fishing population can scarcely be said to belong to the towns, though affected by many of the conditions of town life. All along the coast-line of the British Isles and other countries, yet centred in fishing ports of greater or less importance, there they live, a hardy, adventurous race, ready, at all hazards, to gather the inexhaustible spoils of the sea.

In several respects the fisherman's lot is worse than that of the agricultural labourer. It was stated in the Report of the Royal Commissioners on Sea Fisheries, that whilst, once in the year, an acre of good land, carefully tilled, produces a ton of corn, or two or three cwts. of meat or cheese, the same area at the bottom of the sea on the best fishing ground may yield a greater weight of food to the persevering fisherman every week in the year. Yet the results to those immediately interested are widely different. There are in the United Kingdom about 120,000 persons constantly, or occasionally, employed in fishing, who with their dependants may be taken at 400,000, and the total annual value of the British fisheries is stated to be over eleven million pounds sterling, giving an average produce of about £27 per head, whilst about 3,300,000, persons employed in agriculture raise annually produce to the extent of about £270,000,000 giving an average of about £82 per head. Accordingly the portion falling to the immediate workers respectively are very different. Whilst of the £11,000,000 produced by the fisheries scarcely thirty per cent., or £3,000,000, go to the pockets of the fishermen, of the £270,000,000, the total produce of land, at least 25 per cent., or about £70,000,000, are spent in wages; giving in the case of the fishermen about £10 per head, exclusive of incomes from other occupations, and in the case of the agriculturist about £21 per head a year, or, taking two earners per family, less than 6*s.* a week for the fisherman and about 16*s.* a week for the agriculturist. Follow, moreover, a fisherman's family and a family of the agricultural labourer in their homes. The fisherman's family have to pay £10 to £12 a year for house rent, the agriculturist £2 to £4 per annum. The agriculturist family has vegetables in abundance always at hand, the fisherman's must purchase everything.

But how is it that the fisherman gets comparatively so little of the produce of his labour? Can any economy be effected in the disposal of the fish? Would not the contract of wages, which would leave the master free to economise the produce, prove more advantageous than the present system? Or would not a contract of partnership between the owners and the fishermen, in the shape of the Commandite principle, answer the purpose better still? What can be done to render the industry more productive and more profitable? Could not steam power be introduced in British fishing vessels as the French have introduced in theirs? Are not the boats used too small in most cases? Are the gear and nets all that can be desired? And what can be done to introduce more safety to life and property? Can the electric telegraph be better utilized for the announcement to fishing vessels already at sea of threatening storms? Is there not great need of larger and more frequent harbours of refuge all along the coasts? Are the boats and gear sufficiently insured, or can any system of mutual insurance be safely introduced? Is life insurance sufficiently appreciated by our fishermen? Exposed to constant danger, do they take advantage of that beneficial system to provide that in case of loss of life their friends and relations shall not be left altogether forlorn? The Post Office Savings Banks are extensively diffused. Do they enter all the nooks and corners of the coast, so as to encourage thrift and self-reliance among all connected with the fisheries? These are the questions which determine the economic condition of our fishermen.

The programme of the Great International Fisheries Exhibition divides the subjects under this class into—1st. Apparel and Personal Equipment; 2nd. Food and Medicine Chest; 3rd. Models and Plans of Dwellings; and 4th. Contracts of Partnership, Insurance of Life, Boats, Gear; and other branches, however, will probably be suggested at the conferences to be held on the economic condition of fishermen. A gracious Providence supplements the riches of the earth with the riches of the sea for the sustenance of the many millions of the human race. And it should be our endeavour, not only to advance as much as possible the conditions of the industry, but also to improve the economic condition of those engaged in the same.

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CLASS III.—COMMERCIAL AND ECONOMIC.

PREPARATION, PRESERVATION, AND UTILISATION OF FISH AND ALL FORMS OF LIFE INCLUDED IN CLASS V.

THIS class has been divided into two groups, consisting (1) of those products of the fisheries, which by undergoing some process of preservation can be made available as useful articles of food for weeks, months, or even years after the fish so treated has been caught, and (2) others from which oils, manures, and materials applicable to mechanical, agricultural or ornamental purposes are obtained.

Attention may first be directed to the various modes of curing fish for edible purposes, and these are mainly included under salting and smoking, although simply drying in the air is sufficient in some cases as a rough mode of preservation. In our own country, and especially in Sweden and Norway among continental nations, curing operations have long been extensively carried on, and wholesome competition between them to meet the requirements of the German and other markets has done much to ensure the strictest attention being given to the selection of the best fish and all that is necessary for perfection in curing. This especially refers to what is known in this country as the "White herring cure," a method of preservation which employs thousands of men and women in Scotland, and which a special Board of Fisheries takes under its immediate superintendence, and certifies with its brand on the casks if the curing has been properly done, and the curers desire the official marks. The preparation of white herrings is very simple, and essentially consists in packing the fish in salt, which soon turns to brine, and this method of preparation is termed the "wet cure." The same method is applicable to other kinds of fish, particularly to cod and ling, and with some little modification, to pilchards, which in Cornwall and on the north coast of Spain are largely cured for the Mediterranean markets. The great distinction between the treatment of pilchards and other kinds of fish cured wet being in the fact of pilchards being piled up in alternate layers of fish and salt on the ground for a few weeks before they are finally packed with salt in the barrels. By this treatment a considerable quantity of useful oil is obtained from them, and the fish are rendered more palatable. The numerous examples of fish from various countries cured by merely salting and drying show how much may be done in preserving fish for food with little trouble and at a trifling cost. The important fisheries of Newfoundland will represent this method of curing. Another mode of preservation is that so familiar on our tables in the form of sardines cured in oil. This method is applied to several kinds of fish in foreign countries, but has been only tried in our own within the last few years, and that with young pilchards, the fish which in France are so largely cured and sold under the name of sardines.

Curing with salt and smoke is a more elaborate process, which is especially carried out in this country, and the several models of curing-houses here exhibited well illustrate the manner in which red herrings, bloaters and kippers are prepared for the home and foreign markets, and will be examined with general interest. This mode of curing has been enormously extended within comparatively recent years. Many people will be surprised to hear that hardly more than thirty years ago, when trawling was beginning to be systematically carried on in the North Sea, haddocks were caught in such vast numbers that there was hardly any market for them, and the fishermen were ordered to bring only a certain number ashore. Tons of them were then thrown overboard again: but the plan of smoking these fish was suggested, and proved so successful that quite a new industry resulted from it, and now smoked haddock is so abundant that it comes within the reach of almost the poorest of the population. The preservation in tins of everything which may be roughly included under the head of fish forms another very important industry, especially on the other side of the Atlantic, and large supplies are sent to this country, much of it to be again exported all over the world as well as for consumption on board ship; and this in addition to the well-known productions of our own manufacturers. The universal demand for fish in some shape, whether fresh or preserved, is constantly increasing; and when it is remembered that really good fish is only found in any abundance in temperate or cool climates, and that comparatively few countries are fortunate enough to possess a favourable coast under such conditions, the advantages of being able to preserve fish in a fit state for food for long periods so as to bear carriage all over the world cannot fail to be properly appreciated.

In addition to the various kinds of cured or preserved fish, numerous articles coming under the head of fish products deserve some attention. Such are medicinal oils, roes, sounds, gelatines and isinglass. These are for the most part the productions of northern climates, and wherever the cod fishery is carried on with the object of curing the fish, the livers and roes are carefully kept, and form an appreciable item in the results of the fishery. It is a matter of some interest that the success of the sardine fishery in the Bay of Biscay is largely dependent on the fishermen being supplied with plenty of cod-roe. It is used as bait, and after being broken up, the separated grains are plentifully scattered among the nets as they float in the water, and the sardines in their eagerness to obtain this attractive food, find their way into the nets and are caught. Caviare, one of the peculiar products of Russia, is prepared from the roe of various species of sturgeon, and undergoes little preparation beyond salting and pressing: but many examples will be observed among the productions of other countries, especially of Sweden, of the roes of several kinds of sea fish prepared in the same manner as the original Russian caviare. The refuse of fish is utilised to some extent by being converted into manure or fish guano; and sprats in this country during the height of the special season when these fish are most abundant and the ordinary markets are glutted with them, are sold in thousands of bushels direct from the fishing vessels, and conveyed inland by the neighbouring railways to be thrown on the fields. The different oils obtained from sundry kinds of fish, seals and whales, will attract attention from the many uses to which they are applied, especially for lubrication, and the true fish oils have a special value in the preparation of leather of various kinds.

Pearls, mother-of-pearl and tortoiseshell, being the special productions of warm climates, are best represented in the exhibits of some of our colonial possessions and countries near the tropics. Ceylon pearls have been famous for centuries, and still take their place in the market, although the supply is small compared with that from the Persian Gulf and a few other localities. The shells of the pearl oyster are represented in various stages of growth, and showing the nacreous lining of the same material as that of which the pearl itself is entirely composed. The mother-of-pearl, as this substance is called, is in these oysters too thin and small to be useful for manufacturing purposes, and this beautiful material, so much used for ornamental work, is obtained from a much larger oyster, the shell of which is thick and massive, and whose value depends almost entirely on the shell itself, and not on the small pearls produced in it. A large collection of objects will attract attention from their beauty and the variety of purposes to which the skins of certain kinds of fish and reptiles are applied, notwithstanding their unpromising nature; and much interest will be felt in the beautiful display of coral, tortoiseshell and shell ornaments, and the several methods by which they can be turned to account.

Returning once more to the large subject of obtaining an abundant supply of fish as an article of food, we find numerous appliances for keeping the fish cool during transport from the sea to the market, and this section deserves careful examination, as the main principle of refrigeration or cooling here illustrated has an important bearing on the question of transporting other kinds of perishable food from distant countries. Finally, attention may be directed to the several plans and models of fish-markets, with their arrangements for the quick receiving and delivery of the fish, and altogether it will be noted that large as are the interests of those concerned in the actual fisheries, those connected with the transport, preservation and disposal of the fish are hardly less important.

E. W. H. HOLDSWORTH.

MACHINERY IN MOTION.

MACHINERY IN ITS APPLICATION TO FISHING.

MACHINERY, in whatever form, is from its very nature and origin indissolubly connected with civilization. Its conception needs years of accumulated thought; its construction requires stores of accumulated wealth; and its application demands large fields of accumulated material. No one, unless he have had long practice in such kind of work, can design off-hand an effective instrument for executing the purposes of the simplest handicraft. No one can go a single step out of the regular course of trade without becoming involved in expenses to which he can foresee no practical limit. No one would dream of incurring the outlay of time and capital needed for the erection of machinery, unless the store of materials for which it is destined far exceed the amount which could be worked in the same time by hand. Now these three qualifications alone, accumulated capital, accumulated labour, accumulated thought, form three main elements in the analysis of material civilization; but there is a further aspect to the question which indicates the need for a still higher degree of culture. The introduction of machinery inevitably entails an increased demand, both upon the moral and intellectual qualities, in proportion to its own power and complexity. Vigilance, patience, concentrated attention, strict fidelity to orders, combined with latent fertility of resource, liable at any moment to be called into action—these and other similar qualities are absolute essentials for the machinist, and are developed in him by the mere pursuit of his daily occupations. Accordingly, the progress made from a material point of view by the various classes of the body politic may be to a great extent measured and defined by the ingenuity of instruments adapted for the purposes of their industry, as for instance in the *bonanza* farms of America, where every kind of agricultural process is accomplished by steam. In this light the application of machinery to fishing possesses a peculiar interest, for it shows how the barriers of centuries are silently giving way, and the character of poverty and simplicity, which for so long distinguished this ancient industry, is gradually, not to say rapidly, changing beneath the combined influences of wealth and thought.

An inquiry, therefore, of the extent to which machinery now enters into the apparatus of fishing is evidently a matter of high interest, both from a commercial and a social point of view. An analysis of this kind can only be properly performed, of course, by an examination of the particular instances wherein machinery has been successfully applied, and as no more favourable opportunity for such an investigation can well be conceived than is afforded by the collection contained in the present Exhibition, it will be advisable to take a glance at some of the chief exhibits of this nature, so as to possess some practical basis for generalization. A very brief survey suffices to show that in the case of fishing, as of a hundred other kinds of labour, the principal agent in effecting change has been the power of steam. For the reception of this power trawling, itself a device born of the present century, is peculiarly adapted, both from the greater capacity of its vessels and the necessity of regulating their speed. Accordingly, engines and boilers suitable for steam trawlers, and for the steam fish carriers also, necessitated by the long voyages to the North Sea, form no inconsiderable portion of the articles on view. At one stand, that of Messrs. Ruston, we find the vertical engine fitted as in a boat, with freshwater tanks on either side to save the use of salt water in the boiler. At another, that of Messrs. Rose and Co., we have the famous Kingston winch, with automatic laying-in gear and a whole series of novel appliances adaptable for trawling. The whole mass of water again required for the Aquarium is purified by the Atkins system and Dr. Clark's process, and the same principle could with ease be applied to keeping large beds of our rivers,—containing, say, twenty million gallons of water—wholly free from chalk and other impurities for the preservation and increase of fish. Another ingenious adaptation of steam to steering is that of the worm and worm-wheel motion devised by Messrs. Davis, in such a way that the strain, acting at right angles to the worm, is unable to produce a circular motion, whereby the kick of the wheel, so dangerous to the helmsman and so trying to the gear, is obviated even in the roughest weather. Windlasses too of a special character are here required, both for ordinary purposes and also for hauling in the trawl. In connection with this last point, it may be observed the very simple and easily worked invention for raising ships exhibited by Messrs. Thomson would seem capable of easy application to raising the trawl for those smacks to which steam power has not been fitted. So, again, to accomplish a large catch is much, but to accomplish it without waste is of at least equal importance. How shall the immature fry be permitted to escape? That is a question upon which depends the fate of the whole rising generation of fishes, and therefore of the whole rising generation of fishermen. Mr. Read furnishes us with a tentative answer. The same mesh will be square or lozenge-shaped, according as it is distended laterally or longitudinally, and while in the former case it will allow any diminutive captive to pass out unharmed, in the latter it will inevitably catch them by the gills no matter how small they may be. To avoid this misfortune, and untoward event for both parties concerned, Mr. Read keeps the cod of the trawl extended by a couple of hoops, whereby the lozenge is converted into the square, and the young fish are saved from useless and wasteful destruction. But then it is urged, the mesh when distended is not strong enough to bear a strain; and the square giving more room diagonally than longitudinally, favours the flat fish more than the round, which requires the greater protection. Hereupon Mr. Morris comes forward with his circular mesh of wire which does not yield to the pressure and possesses the advantage of having the same space of aperture in every direction. Nor is the application of machinery by any means confined to the apparatus immediately forming part of a smack's outfit. Gas engines are needed in various ways, such as the Bisschop Engine, which pumps six tons of water into the supply tanks of the fish ponds at Ringwood in the course of one hour, for twopence. Portable forges are in use on board steam trawlers, fitted with sentinel valves, which, by giving warning at a certain temperature, call the attention of the fisherman who may be otherwise occupied at the moment.

The construction of fish barrels affords a large field for mechanical contrivances, and the ingenious set of special herring-barrel machines exhibited by Messrs. A. Ransome and Co., of Chelsea, are a great centre of attraction. These machines, which are kept in full operation, produce better barrels than it is possible to make by hand, at about one third of the cost for labour. The machines, which are very simple, are all worked by unskilled boys' labour; and work up the rough sawn staves into finished casks and heads, leaving nothing to be done by hand but to place the heads in their grooves at the ends of the barrel, and to fix on the wooden hoops. The entire plant, which stands on a space of 34 ft., by 17 ft., is capable of producing 1000 full sized pickle barrels a week.

Of a different class are Messrs. Bateman's devices for self-lubrication, where small cylinders of metaline being set into the bushes of the ship blocks, save endless labour by keeping them automatically lubricated, while their gray emery wheel, being composed of silicate of soda instead of oxydised oil, is not liable to glaze under friction. Then, again, refrigeration is a matter which has taxed the brains of many mechanicians. Provision has been made during some years for the storage and manufacture of ice on board our trawling vessels, but the cold air method is of more recent invention. The dry air refrigerator, shown by Messrs. Haslam, in which the air being first condensed in the top cylinder to about 40 lbs. to the square inch and then cooled by the action of water from without, discharges a volume of air amounting to no less than 40,000 cubic feet per hour at an average temperature of 40° below zero. So many, in fact, are the varieties of apparatus, that we can scarcely enumerate the objects for which they are designed. If the water be too shallow at the bar of a harbour, Messrs. Priestman with their steam dredge are at hand to come to our assistance, while Mr. Thomas presents us with a model of a harbour, so constructed as to make the out-going tide completely overpower the incoming one, and with the additional assistance of his submarine self-acting dredge, sweep away the bar and prevent it from re-forming. Thus we may hope to apply in a different sense the well-known words of Mr. Kingsley, and " bid good-bye to the bar and its moaning," and to all the loss and sorrow which it has occasioned. If on our voyage we are caught in a fog, and in spite of our siren a collision becomes imminent, Messrs. Lafargue suggest an hydraulic gear for steering, by which the largest ship can be instantaneously placed upon any course we may desire. If our vessel is a wreck, and the long boat requires to be launched, the old familiar danger that its crowded contents will be poured headlong into the angry waves is obviated by such gear as is shown by Commander Mark Robinson, wherein the common hook is combined with a slipping apparatus and the simple loosing of a rope instantaneously disconnects the couplings fore and aft at the same time. If we are so fortunate as to require no such apparatus, but arrive unharmed in port, machinery meets us once more, and Messrs. Clarke-Brummel's hydraulic lift is put into requisition for bringing the fish ashore. Or to take an instance which shows into what minute details the use of machinery has entered—most persons who have been at sea must be aware of the action which the saline air is apt to exercise upon metallic articles, and it is no bad measure of the height to which refinement has now been carried in these matters that a point of this kind has received the special attention of Mr. Gorer, of the Gilding and Silvering Company, 29 Edgware Road, London.

On the other hand, the electrical devices and the meagreness of the appliances adopted for saving life, betray the crude and unfinished character of the most elaborately-fitted fishing vessel. Yet here, too, is a field which must by no means pass unnoticed. Here are the ingenious appliances of electricity exhibited by Messrs. Whiting, which, not to speak of their possible power of subduing whales and other large fish with no more difficulty than occurs with horses, are capable, from the peculiar power they possess of contracting the diaphragm and thereby causing the great desideratum of artificial respiration, of being applied with admirable effect in resuscitating the half-drowned fishermen. Nor must we overlook the simple machinery shown by Messrs. Shields for calming the troubled sea by means of oil; nor the luminous paint, which shines calmly amid the wildest drenchings of the tempest; or the asbestos, which preserves a wooden hull intact from the fiercest onslaught of fire and petroleum; or the Messrs. Bapty's invention for establishing communication between lightships and fishing fleets; or Colonel Lambart's raft, which can be thrown overboard in any fashion; or Messrs. Berthon's compressible and easily stowed lifeboats; or Messrs. Wentworth's Kredemnon life-saving dresses, which scarcely encumber the wearer more than ordinary dress, and yet can defy the utmost power of the waves; or the helm signals, which indicate at the mast-head every motion of the rudder; or even the well-known basket and rocket apparatus for the conveyance of shipwrecked mariners ashore, which the Board of Trade exhibits daily. No matter connected with these interests can be of greater urgency, not merely as a matter of sentiment but also of economy, than the preservation of the valuable lives engaged in the service. Yet when the members of the Royal Commission held last year suggested that cork jackets should be assumed by all persons on board the fishing fleet at a signal given by the admiral, or by the captain of the steam cutter, the proposal was finally abandoned on account of the reluctance which the witnesses declared would be felt by the fishermen in taking even so simple a precaution against obvious danger. If the present Exhibition has no other effect than that of preserving a single life by removing this childish though not unnatural fear of imputed cowardice, it will not have been held in vain.

Yet, numerous and grave as are the deficiences in these important respects, it is impossible to review even the brief investigation in which we have been engaged without perceiving that in more ways than we can appreciate, the use of machinery is tending to complicate the immemorial simplicity of fishing, and this is a point of the utmost significance to those who have at heart the welfare of our fishermen. For if there be one axiom inculcated beyond all others by the general history of trade, it is that unless the economic keep pace with the mechanical machinery, the latter will tend constantly to increase the advantages of capital relatively to those of labour. For machinery, as we have seen, involves capital, and capital presupposes the almost insuperable advantage that it can afford to wait. Thus to the decay of the mediæval guilds, those close but strictly co-operative corporations, may be traced no small portion of the convulsions experienced in the industrial world consequent upon the enormous increase of commerce during the last and the present centuries; and the strikes and lock-outs, whereby the respective bodies of artisans and proprietors have beaten each other into some acknowledgment of the rights of each, form but an inefficient and unstable substitute for the organisation which blended the two elements in harmonious growth. Signs are not wanting that a similar atrophy may be setting in with regard to this industry also. The system of apprenticeship which, whether good bad or indifferent, at all events preserved the distinctiveness of the pursuit, is fast becoming extinct. Casuals take the place of seamen for a voyage or two, and then return to their own occupations on shore. Complaints are heard on every side that the owners of vessels experience continual loss through the refusal of the hands to fulfil their legitimate engagements. These are all symptoms that the economical machinery of distribution has not kept pace in development with the mechanical machinery of production; and the very improvements to which we now point in triumph, as evidence of increased prosperity, may prove, unless accompanied by a corresponding advance in the condition of our fishermen, to be the instruments whereby we may come to lose that hardy and invaluable race for ever.

W. M. Adams,
Late Fellow of New College, Oxford.

PREFACE TO CLASS IV.

FISH CULTURE.

Fish-culture in the last quarter of a century has developed aims which remove it very far from the fish-culture of the past. The object of modern pisciculture is to preserve the balance of fish life against the disturbing agencies of modern civilization, by affording, through close and accurate study, a safe basis for legislative enactments, and by restoring the already depopulated waters to more than their pristine wealth. Modern fish-culture embraces alike sea and land; ancient fish-culture, with the exception of a few brackish lagoons, comprised freshwater only. If, however, Diodorus Siculus is to be trusted, fish-culture flourished 3400 years ago, on a commercial scale which rivals any modern industry, as he mentions an artificial lake constructed by Moeris, where the revenue derived from the fishing exceeded a talent a day; and the fish increased so fast that the preparations for salting were insufficient. Passing to China and Japan, fish-culture has long been carried on, but I am not aware that it extends beyond the collection and sale of spawn, and the artificial feeding of young fry, although the telescope fish has undoubtedly become a permanent variety through artificial selection. Roman fish-culture consisted in constructing stews, more for the gratification of luxury than for increasing the food of the country. In mediæval times the institution of the monasteries again encouraged fish-culture; and it is probable we owe to the monks our grayling and our coregonus, and very likely our pike also; but in their time the great necessity for fish-culture had not arisen. The rivers were still unpolluted and the seas undisturbed. That the bays, estuaries, and sheltered parts of the coast may in the immediate future be systematically cropped with crabs and lobsters, and with oysters and edible mollusca—that smelts may swarm in our estuaries, and the deep-sea cod be artificially increased—is part of the object of modern pisciculture. In fresh water the important problem of the culture of the salmonidæ has within the last few years been solved. The discovery of Pinchon, in the fourteenth century, the work of Jacobi in the eighteenth, and again, the observations of Gehin and Rémy* in the latter part of the first half of the present century, paved the way for the establishment of Huningue; while M. Veraskie's notebook in the autumn of 1856 for ever set at rest all difficulties as to artificial impregnation, although probably fifteen years elapsed before his dry method was adopted out of Russia; and to Mr. George Sheppard Page the credit is due of making known M. Veraskie's experiments in America. Results on that continent may perhaps best be expressed by quoting a letter from Professor Spencer Baird, Commissioner of Fish and Fisheries, Washington, to the Commissioner of Fisheries of Canada. "In the Sacramento River we are absolutely certain of our ground, having brought up the supply of salmon to more than its pristine condition of abundance, by planting about two millions of young fish every year. The catch there has increased in five years from five million (5,000,000) pounds to fifteen million (15,000,000) pounds; and in 1881 there was more fish than could be utilized in all the canning establishments on the river." One of the most important points in the study of fish-culture is the selection of the most suitable fish for the purpose in view, and the acclimatisation of new species, to be permanently beneficial, requires great knowledge and care. The cultivation of the food of fishes in fresh water, and its study in salt, will, we hope, receive great stimulus from this Exhibition. In both branches there is a rich harvest to be gathered. The migrations of many species of sea fish depending principally —and the quantities of fresh-water fish a given space will carry depending entirely—on the feeding. Salmon depend on their spawning rivers for quantity, and on their sea-feeding for size and quality. Oysters frequently thrive and fatten best under conditions unfavourable to their reproduction, hence the kindred problems of increasing the supply of salmon and of oysters have something in common, and in future will be largely dependent on artificial culture for their production, and on careful legislation for their increase and development. Salmon ladders will always continue necessary aids to sport, but the rapid strides with which artificial breeding is advancing will prevent their insufficiency telling much longer on our food supply. France, already at the head of oyster culture, is again moving in the matter of pisciculture; and M. Chabot-Karlin, in the Bulletin du Ministère de l'Agriculture, 1882, reports on the project of forming sixteen chairs of pisciculture throughout France, and in the first bulletin for 1883 he reports that in Belgium the government has, by the creation of a vast piscicultural establishment, commenced the restocking of the Meuse Supérieure—that in the grand duchy of Luxemburg the best practical results in Europe have been obtained—that in Germany success has been obtained by official encouragement to private societies, of which that of Metz offers a valuable model—that Holland, by a system of prizes for stocking waters, has produced the best results, and, through its concessions of the public domain, has carried oyster culture to the highest point in Europe. Of the countries not mentioned in the report, Norway and Sweden are fully alive to the value of pisciculture; Austria also possesses many establishments. Russia has long given much study to fish-culture: the inspector of fisheries in Finland, Professor Malmgren, has just issued an important report. Salmonidæ have been successfully introduced into India, first by Dr. Francis Day, and to the Antipodes by Messrs. Francis Francis and Youl. It requires only the collection and distribution of the knowledge of the world's work in fish-culture—as we hope it will be collected and distributed through this Exhibition—to make an acre of water more valuable than an acre of land, and the toilers of the sea reap many fold their present harvest.

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* *Rapport sur la fécondation artificielle des poissions.* Paris, 1851, 8°.

J. R. G. MAITLAND.

AQUARIA.

IT was not until the Executive Committee of the International Fisheries Exhibition became aware of the immense size which it was rapidly attaining, and of the vast national, not to speak of international importance with which the undertaking had become invested, that the idea of erecting a series of sea and fresh-water aquaria was practically taken into consideration. Nor was it after either the first or second anxious discussion that the Committee felt justified in incurring the large outlay and truly gigantic amount of labour, both theoretical and practical, which the task of building even a small aquarium under favourable conditions necessitates. A very little thought will suffice to realize how arduous and varied were the duties which by such a resolution the Executive Committee undertook. Their first act was to select a Sub-Committee, formed of those gentlemen who were not only eminently qualified and capable, but also willing to plan and execute the best system by which the numerous difficulties caused by an unsuitable locality could be most easily combated. The list of this Committee included the following well-known names, who have laboured hard since October last to carry out the work which now speaks for itself:—Sir James Ramsay Gibson Maitland, Bart., T. J. Mann, Esq., Col. Stuart-Wortley, A. G. Jardine, Esq., Francis Day, Esq., W. Fell Woods Esq., Oldham Chambers, Esq., J. T. Carrington, Esq., and Henry Lee Esq.

After the closest inspection of the portions of the gardens available for the purpose, the Committee ultimately decided upon the present position, known generally as the West Arcade, for several weighty reasons, such as solidity of foundation, existence of a heavy concrete roof, and the immunity conferred upon it by its position from the rays of a summer sun, which would have acted seriously on the temperature of the water, while the presence of spacious cellarage at the southern end afforded the means of procuring a large reservoir for the storage of the necessary sea water. Although the period for which it is proposed to keep the Exhibition open is only six months, yet the Committee have had all the work in connection with the tanks executed in the best materials, so that there may not be any chance of those small leaks which have proved such deep sources of trouble in nearly every existing aquarium. In carrying out the work the Committee have had the benefit of the great experience of Mr. H. C. Norman, of the firm of Messrs. Leete, Edwards and Norman, of Euston Road, in conjunction with whom he has superintended the fitting up of the vulcanite circulation system to the principal existing aquaria. The brickwork is entirely of the best brick fixed in cement, and was set under the personal supervision of Mr. Wilson Bennison, who, in connection with the late Major-General Scott, C.B., has most efficiently carried out the arduous task of erecting the Exhibition buildings. In order to meet the demands of numerous exhibitors, and to enable them to make the Aquarium thoroughly representative, the Committee found that it would be necessary to build nineteen tanks for sea and fresh water, and twenty smaller tanks for sea water alone. As the appearance of these tanks when merely finished off with asphalte and slate, respectively, appeared to the Committee to be somewhat unattractive, they determined to face them with rock-work, and found in Mr. Pulham, of Broxbourne, Hertfordshire, a talented and willing contractor, who, in spite of the difficulties which are caused by the use of lime in any active form, has executed his work with much taste and skill, at a merely nominal cost. The water for the sea-water tanks has been obtained direct from Brighton, and has been supplied by Messrs. Hudson & Co., of Pimlico, whose extensive plant, employed for the sea-water supply to the Crystal Palace and Westminster Aquarium, obviates the danger of any impurities being brought into contact with the sea-water in transit. The total bulk of water in circulation through the ten large and twenty small sea-water tanks and reservoirs is upwards of 65,000 gallons, and the entirety was conveyed from Brighton to South Kensington at a fixed rate of 5000 gallons per day. The remaining nine large tanks are fresh-water tanks, and to prevent the fish being exposed to the variations of quality and temperature of the ordinary West Middlesex Water Company's supply, the Committee have availed themselves of the kind offer of Messrs. Atkins & Co., Sanitary Engineers, of 62 Fleet Street, to place at their disposal one of their large water-softening and filtering apparatus, which will, as the fresh-water tanks are provided with underneath reservoirs, allow of the same water being kept continuously in circulation, and will of itself prove a great saving in expense, besides benefitting the fish. The question of stocking an aquarium being one of great difficulty and also expense, Lord Walsingham, who has presented 1000 freshwater fish of various kinds, the Duke of Bedford several species of carp and other fish, the Marquis of Exeter trout and black bass, the Duke of Portland trout, Sir James G. Maitland trout, and numerous others, have by their generous gifts tended very greatly to mitigate the arduous task of the Stocking Committee, who have yet had to use every endeavour to arrange for an adequate amount of sea-water fish and crustacea. In order to procure an independent supply of the former, the Committee engaged the services of a smack-owner to trawl for them in the channel for three weeks ; and as the managers of the Brighton Aquarium kindly consented to receive and store the takes of fish in their spare tanks, so as to give them a break in the voyage from Brighton to the Exhibition, the Committee have been enabled to stock their tanks with, so to speak, partially educated fish. As regards crustacea, the Committee are indebted to Messrs. Poland Brothers, of Billingsgate, who have supplied them with a very fine exhibit of lobster, crabs and crayfish ; and Messrs. Lynn and Gibson, who display an appetising show of shrimps, prawns, and other crustacea. Another, and perhaps almost the most attractive, branch of the Aquaria is that which contains the anemones, for the finest specimens of which the Committee are again indebted to the Directors of the Brighton Aquarium, who have given every assistance to procure a thorough and handsome collection. It will be well, perhaps, for those visitors who take any interest beyond mere curiosity in an aquarium, to try and realize for a few moments the seemingly overwhelming difficulties which appear to crop up on all sides to those who undertake the formation of one. So numerous are the questions which have individually to receive the deepest discussion, that it is quite impossible to consider them in a short preface ; but it may be as well to mention some of the few principal ones. The first question is the quantity, quality, and direction of the supply of light, which, if not of the most perfect and direct kind, will entirely prevent the finest aquarium from ever becoming a success. Second only in importance are the questions of foundation and drainage, as the slightest error in either of these causes not only leaks in masonry, but signs the death-warrant of the costly plate glass. Next the temperature and quality of the water to be used give a vast amount of anxiety, and when, in spite of all difficulties, the naturalist has erected for himself an aquarium, and the tanks appear to be in the highest degree satisfactory, he has the disappointment of learning that the light which he has been so assiduously arranging for the benefit of the public is a deadly enemy to the fish. These are merely the larger troubles, and as such sufficient to prove to the visitor's mind the public thanks which are due on all sides to those who lend all their science, knowledge, and energy for the public good.

HARRY W. TOWSE.

NATURAL HISTORY.

WHEN investigating fisheries, their present uses and the benefits which might be derived from them, the inquirer soon becomes conscious of the necessity of studying many branches of "natural history," both in the vegetable and animal kingdoms, without a competent knowledge of which his labours will often be thrown away, or the results of his researches useless, if not positively misleading. Fisheries are variously regarded by different classes; thus, the fisherman chiefly concerns himself as to what he can obtain from them at the present time, regardless of suitable provisions for the next year's supply. The public mainly interest themselves in the cost of the fish as disposed of for food; while the scientific economist bases his conclusions respecting the value of fisheries in accordance with their produce, and, should the supply be unequal to the demand, he mostly advocates increased killing powers by the employment of more destructive agencies, erroneously believing that the stock in the sea is inexhaustible. The naturalist and fish culturist ought to approach the question from an entirely different point of view; he should ascertain the life-history of all forms of fishes, not merely such as serve for human food, but also of those which form the sustenance of the more predaceous kinds. He should endeavour to collect reliable information respecting the plants and animals which afford them sustenance and shelter, as well as ascertain what are their enemies or their friends, and what conditions favour the presence or absence of either class. Irrespective of the foregoing, he should consider the relationship of temperature, currents, soils, and the various conditions of the water in which they reside, to their migrations, growth, health and reproduction. He should also ascertain whether fish are increasing in numbers or decreasing, or if the supply remains unchanged; if the size of those captured is augmented or lessening; if their condition is better or worse than it was. Should investigation lead him to conclude that fisheries are being unduly depleted, he should carefully note in what families of fish such is occurring; if possible, the cause; while in marine forms it is likewise necessary to inquire if fishermen have to go further out to sea to obtain their captures, if the killing powers of their implements have increased, and whether more men are now required to obtain the same amount of fish than was the case a few years previously. Lastly, it may be observed that, unless the investigator is able to distinguish the various species, he may easily imagine that he sees in some small forms, as the splonette (*Solea minuta*), the young of the more valuable kinds, as the common sole (*S. vulgaris*), whereas he is merely examining one sort that is worthless, except as food for the larger kinds. Our fresh-water fishes are divisible into the river or "fluviatile," and the "lacustrine" or lake forms, while our marine ones may be considered as shore or "littoral" and "pelagic" or sea species; these last being again subdivided into such as are generally found near the surface, at greater, or mid-depths, and abyssal residents, or such as live in the deep sea below the limits to which the sun's rays penetrate. Fresh-water fishes may be permanent residents therein, as carps; "anadromous," or merely visitants from the ocean for the purpose of depositing their spawn, and generally, but not invariably, leaving their young to be reared there, as the salmon; "catadromous," or such as reside in fresh waters, visiting the littoral zone or sea in order to breed, as eels, the young of which ascend into and are reared in our rivers. To meet the destructive agencies to which the eggs and young are subjected, fish are provided with a large amount of ova, which is mostly sufficient to counterbalance natural waste. Thus eleven millions of eggs have been taken from a 21-lb. codfish: 550,000, from a mackerel; 239,775, from a brill; while a salmon deposits about 800 for every pound's weight of the parent fish. Although most forms are polygamous, some are monogamous. The period of the year at which spawning occurs, the size of the eggs, the depth of the water in which they are deposited, the time they take incubating, and the places selected for the ova are exceedingly varied. The eggs of cod float in the sea until the young emerge, those of the herring sink to the bottom, where by means of a glutinous substance they are attached to sea-weeds, rocks and other objects;

those of some species of flat fishes float so long as the water is agitated, subsiding when it is smooth. One form of sea-sucker (*Lepidogaster*) affixes its eggs to the inside of a dead shell, as a butterfly does to a leaf. The gar fish (*Belone*) has filaments springing from the outer covering of its ova, which enables them to adhere together in a mass or attach themselves to contiguous substances. Anadromous forms deposit their eggs in running waters, but in different ways; thus the smelt affixes its ova to planks, stones, &c., near high-water mark; the salmon and trout cover theirs with gravel, while the grayling deposits it on the bed of the river. Perch and most carp attach their eggs to water-weeds, sticklebacks construct a nest, while in the tufted gilled fishes, represented by the pipe and horse-fishes, the male undertakes the functions of a nurse, the eggs for this purpose, up to the period of the evolution of the young, being retained between the ventral fins as in certain pipe-fishes (*Solenostomus*), in tail pouches as in horse-fishes (*Hippocampus*), or in receptacles on the breast or abdomen as in the pipe-fish (*Doryrhamphus*), or merely in two rows in the same position as in *Nerophis*. The males of some tropical sheat fishes or Siluroids also perform maternal duties by carrying the eggs about in their mouths until the young are hatched. In some forms, as lampreys, the expulsion of the roe is mechanically assisted by the two parents fixing their sucker-like mouths to a convenient rock and entwining themselves round one another. Also in carps, as in the common goldfish, the male has been observed to roll the female over and over at the bottom of an aquarium until her eggs have become expelled. Hybrid fishes are likewise deserving of great attention, as in fish culture crosses between the trout and the charr have proved most successful, while the stocking of fresh waters by artificial means, and latterly the sea, are among the most satisfactory accomplishments of modern fish culturists and naturalists. Young fishes for varying periods after birth are sustained by the nutriment contained in the yolk of the egg or dependent umbilical sac, and during this period they have numerous enemies watching to make them their prey. Unable to stem strong currents, they are generally to be found concealed near the sides of streams or ponds, or else under the shade of stones, leaves of water plants and grasses; while the marine species are among the algæ in the sea, or disporting themselves in the sunshine, and these places may be considered their nurseries, which should not only be left undisturbed, but protected from predaceous foes. As the yolk sac becomes absorbed, the fry of fish have to seek for their food, whether of a minute vegetable or animal character, and it is then that the eggs and young of other lower classes of animals (the invertebrata) become invaluable for their subsistence. In some places around our coasts, or in fresh or brackish waters, are various kinds of sea-weeds, or algæ, which in the sea decrease in abundance with increasing depth; or should they drift into deep water they fall to pieces, sink, and form the basis of soft black mud, in which many forms of invertebrates find their food, while in their turn they afford sustenance for fishes. Besides sea-weeds being useful along our coasts as providing food for fishes, places for depositing their spawn, nurseries for sheltering and rearing the fry, there are likewise forms, some of which are miscroscopic, floating in vast quantities over the surface of the deep sea, as the so-called Sargassum or gulf weed. Sponges, in both their fresh-water and marine kinds, and which equally belong to the group Protozoa, were long considered by some authors to be vegetable, by others to be animal organisms. The horny skeletons of some species are exceedingly useful for domestic purposes, while those of commerce are to a great extent brought from the Grecian Archipelago, the Red Sea, and the Bahamas, where they are obtained by divers. Many of the Cœlenterata, as the compound colonies of the fixed and plantlike sea firs (*Sertularidæ*) and their allies, are found in our seas, some in large quantities, and they are consumed by fish and other marine animals. There are also in this group the jelly-fishes, medusæ, which during the summer and autumn months are found floating in the ocean around our coasts, and occasionally under their umbrella-like discs young fish have been observed to obtain refuge from the pursuit of their enemies. Corals among the Actinozoa in many ways hold a most important place, while their hard structures are exceedingly diversified and interesting. Commercial forms are principally obtained from the Mediterranean, the Red Sea, Persian and Arabian Gulfs, the Mauritius, the Islands of the Malay Archipelago, Japan, &c.; while the reef-constructing species are distributed, and can only exist where the mean temperature of the sea is not below 66°. The coral reefs are classed as forming Fringing reefs, Barrier reefs and Atolls. These reefs are largely frequented by fish, some of which possess most gorgeous colours, but in many instances it has been observed that the flesh of those obtained from such localities is frequently poisonous. Among the jointed Annuloida the term entozoa has been frequently used for the purpose of designating internal parasities. Epizoa, on the other hand, is the term employed for certain small Crustaceans which, in their adult stage are likewise parasitic upon the exterior of fish; they possess a suctorial mouth and limbs furnished with hooks, suckers, or bristles.

Mollusca, or soft bodied animals, commonly known as shellfish, constitute a most important class in the economy of fisheries, not merely in their providing adult fish with food, but also, as some of them breed at the same period of the year, their eggs and microscopic young are useful as aliment to the fish fry. Some forms are likewise more directly employed by man as food and bait, as oysters, mussels, cockles, and periwinkles. The consumer needs no reminder as to how scarce the first have become; and along the east coast of Scotland mussels for use as bait are attaining famine prices, while the belief appears to be almost general that there mussel fisheries are retrograding. Many other forms of molluscs are much employed by line fishermen for bait, especially whelks, squids, cuttle-fishes, &c. Among the marine Echinoderms, viz. sea urchins, star-fishes, and the sea-cucumbers, *Holothuridæ*, all assist more or less in providing food for fish, while a species of the last is largely consumed as food in China, where it is looked upon as a luxury under the name of "trepang." The true worms, or Annelides, are indispensable to fisheries. They are divisible into the abranchiata, or gill-less forms, which contain earth-worms and leeches, and the branchiata, or gilled kinds, which include tube-worms and sand-worms, &c. The Annelides comprise many forms largely employed as food for fish, and some, as the lob-worm, are very useful for bait; others, as leeches, are detrimental to fish. Insects have been said to be nature's most favoured creation, having combined in them all that is beautiful and graceful, interesting and alluring, or curious and singular in every other class of her (nature's) productions. They are placed by entomologists in three great divisions, in accordance with whether they pass through a metamorphosis or not, and if they do whether such is complete or incomplete. Many insects form food for fishes in some stage of their existence, while others are very destructive to fish eggs. Crustacea are most generally known as lobsters, crabs, shrimps, prawns, &c., and are variously divided by different zoologists. All crustacea are water breathers; some having eyes placed upon footstalks, while in others they are without stalks, being sessile or immovable. All undergo successive moultings or changes of shell, at which times lost parts become renewed. In the earlier stages of the lower crustaceans, they emerge from the egg as a small body having a central eye and two pairs of limbs (so-called Zoea stage), while as they gradually attain the adult stage new segments and new limbs appear. In their earlier stages crustacea become a most important article of food for fishes, while their adult forms are likewise esteemed by the more predaceous kinds. The class of Amphibia comprises, newts, frogs and toads, and in some localities frogs play a not unimportant part in fisheries, as they not only devour the ova but likewise the fry, while their own spawn in turn becomes food for fish, and a frog is highly esteemed by many fresh-water fishes. Reptiles (or Reptilia), including tortoises, turtles, terrapins, snakes, lizards, crocodiles and alligators, are more destructive to fish than are the true amphibians. The Chelonians are usually divided into the swimming turtles, the mud turtles or soft tortoises, and the terrapins, and lastly, the land tortoises. Some of the snakes and serpents are frequently found in fresh water, where they are inimical to fish; while in the seas of hot climates are the venomous water-snakes (*Hydrophidæ*); these have a laterally flattened tail, lead an aquatic life, and live mostly on fish. Crocodiles and alligators abound in the fresh and brackish waters of hot countries and are large consumers of fish, but the form best adapted for this pursuit is perhaps the gavial of India, which often attains to twenty feet in length, and is a resident throughout the Indus, Ganges, Brahmaputra and Mahanuddi rivers. The Gavial possess a long and slender snout with a narrow mouth, they toss captured fish into the air, and as they descend catch them and swallow them head first. Among birds, as is well known, not only are the swimming ones, as the gannets, cormorants, gulls and terns of our coasts, largely destructive to sea fish, but the last two extend their range to inland waters, where, however, the dabchicks, coots, moorhens, herons, &c., assist in depopulating fisheries. Among mammals the whale and seal fisheries are of great importance commercially. The whales, dolphins, and porpoises, or Cetacea themselves, destroy immense quantities of fish. So also do the semi-aquatic or amphibious seals; while the otter, in fresh and brackish waters, is a large fish consumer, although in the East it appears mostly to prefer frogs.

FRANCIS DAY, F.L.S.

HISTORY AND LITERATURE OF FISHING—FISHERY LAWS—FISH COMMERCE.

THE history and literature of fish and fisheries form in themselves a veritable ocean, the inhabitants of which are of the most varied nature, from the chatty pages of Walton to the useful but scarcely inviting Tables of Parliamentary Statistics. This voluminous treatment may occasion surprise to persons unacquainted with the extent and intricacy of the subject; but its cause will be readily perceived by any one who considers the complexity of the relations involved, as well as the multiplicity of species and properties. Not merely do fish afford one of the chief staples of human food, but they are the only denizens of the element which covers by far the greater portion of the earth's surface. When to these considerations it is added, that they are apparently quite incapable of domestication, that some of the finest sorts soon dwindle and die out unless a perfectly free course be opened to them through river and ocean, that their capture is the source of innumerable jealousies, and that physical means can scarcely be devised for protecting piscatorial rights whether vested in communities or individuals, the wonder arises not that so much has been written, but rather that there should be any end to controversy. Fishing, whether for business or pleasure, is considered by English people, and indeed by mankind in general, as primarily a pursuit in which all the world may engage wherever, whenever, or however they please; and the only limitations to its exercise have their origin either in a defective right of access to the waters or in the necessity to preserve a continuance of supply. Thus, on the high seas every one may catch whatever fish they can, with whatever means they are able to employ, so long, of course, as they do not interfere with the superior right of navigation. On the other hand, it is clear that when a coast is approached, certain rights over the adjacent waters must naturally belong to the people of the country; so that foreigners cannot exercise their occupation within some conventional distance (three miles from low-water mark is the point determined) without licence from the government. Hence arises immediately the necessity for international agreement, and one of the earliest conventions between Great Britian and the newly acknowledged American States, had regard to the fisheries of Newfoundland. Direct piscatorial rights, too, are by no means the only objects of diplomatic intervention in these matters; and not many years have elapsed since the position of seamen in distress, and the distribution of their estates, when deceased, became regulated by treaty between our own Government and those respectively of Germany and Italy. Rivers, again, in so far as they are navigable, are open to all natives of the country through which they run; but where access can only be obtained from the banks, both they and the fish contained in them are considered to belong to the riparian proprietors. Angling, it may be here observed, stands upon precisely the same footing as net fishing, except that the open season is protracted for a short time in order to balance in some degree the nights and unfavourable days during which nets only can take effect, and that trespassers with the rod are liable to rather lighter fines. The duration of the period during which fishing is prohibited for fear of injury to the spawn, has caused endless discussion and legislation; while the construction of wears or weirs has been a fertile source of dispute since the days of Magna Charta at the very least. The regulations upon these subjects are altogether miscellaneous, not to say conflicting, and vary both with the species and the locality. Salmon, indeed, like the house of Courtenay, is so lordly in its nature, and so migratory in its habits, as to require nothing less than a chapter of history all to itself. But the herring, said to have been introduced into England by Cerdic, in the days of Romulus Augustulus, can boast of a lengthened pedigree, and the royal whale lays claim to no slight consideration. In fact, if any one desired to become familiar with the history of this extensive branch of the animal kingdom, it is necessary that he should acquaint himself not only with the haunts and habits of the fish, but also with the Treaties, Charters, Acts and Regulations whereby the original freedom of universal piscatory has been abridged in accordance with international, municipal, or special declaration. The theme is by no means dry, or wanting in those glimpses of national character which give colour to historical research. In classic times piscatorial rights, both public and private, were commonly recognised, as is shown by the allusions of satirists, and the numerous technical terms in use. At Pompeii, for example, if we may argue from the frescoes still extant upon the walls, angling must have been a very favourite employment. Amongst our own ancestors, the Anglo-Saxons fed largely on fish, but the Britons are said to have refrained from them out of reverence for streams and rivers, and the alleged aversion of certain large classes of the poor to this article of food may possibly be a survival of this notion. In the Venetian edition of the Older Salic Law, a fine is exacted of "MD. Denarios, XV. Solidos" for the theft of a fish. Feudalism developed the parcs or private ponds of great seigneurs to a most elaborate extent, and the Fifth Book of the *Ordonnances* of Louis XIV. enters into very minute particulars. The *Code Rurale* also, published by Royal Privilege in 1775, contains many interesting details of a system swept away a few years afterwards, like so many other remnants of Feudalism, by the force of the Revolution, in which so conspicuous a part was played by the *Dames de la Halle.* For the comparative freedom with which our own arrangements have been conducted we are probably indebted to the existence of the celebrated Fishmongers' Company, or "Mistery of Fysshemongers," to use their ancient title. The charters of this wealthy and famous Society carry us back as far as Richard II. The amalgamation of the two Guilds of Stockfishmongers and Saltfishmongers took place in the times of the Roses: their Common Seal stills bears the cross-keys of their patron the Fisherman; and the Fire of London is an event of yesterday in their annals. Other nations may have established a commerce as extensive and remunerative, but seldom has such a commerce been enjoyed for so long a duration. Of the foreign rivals of the Company—domestic they had none—by far the most formidable came from the sea-loving country of Holland, which at one period almost succeeded in taking the whaling trade out of British hands. A manuscript in the Harleian collection, bearing date 1632, contains "A discoverie of the Hollanders' Trade of Fishinge, and the circumventing us therein; the means how to make a profitt of the fishinge, by which they have made and yet doe reape soe greate a benefitt, with the profitt, honor and securitie that will redounde to his Ma^{tie} and all sorts of subjects within his Ma^{ts} three kingdomes by it. Written by Sr. Wm. Munson, Knt., sometyme Vice Admiral of England, and now in agitation togeather with his Ma^{ts} Letters Pattents for the Execution of the same." Ninety years later a report upon the loss of the Greenland fishery was drawn up by order of Sir John Eyles, Governor of the South Sea Company. Of the high value placed upon the trade as regarded both from the political and the commercial point of view, the following passage will enable us to judge: "Is it to be expected," says the author of the Parliamentary History, discussing the proceedings of the Scottish Parliament relatively to the Union, "that Holland will suffer us to improve our fishery, which is their nursery for seamen, a livelihood to many families, and an immense treasure to the public?" Such are some of the incidents which illustrate and enliven this characteristic portion of our national life; nor is the interest of the study by any means confined to archæological or historical details. On the contrary, many questions relating to our fisheries are of vital and permanent importance to large masses of the population; and the welfare of the classes employed in these pursuits, the means for extending the consumption of fish amongst the poor, the discovery of new fishing-grounds, the acclimatization of fresh species, the improvement of piscatorial implements and methods, and the establishment of Government vessels for the better instruction of fishermen, are but a few of the innumerable topics relative to these matters to be found in the columns of Parliamentary Reports. And when the reader has become familiar with the varied story and multiform relations of this deeply interesting branch of the animal kingdom, alike in its scientific and commercial aspects, he cannot do better than pay a visit to the lecture room of the Exhibition, and there learn how the whole of this widely-reaching literature and organization is but the preliminary step towards the much needed development of this valuable food for the teeming and ever-multiplying millions of our poorer population.

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ISLE OF MAN.

The Isle of Man is an island in the British Seas, 35 miles long and about 12 miles at its greatest breadth, containing an area of about 350 square miles, and a population of 53,492 souls. The island enjoys the advantages of Home Rule. It has its own legislature, its own judicature, and an independent revenue. There are five ports in the island from which fishery operations are mainly conducted, viz., Douglas, Ramsey, Peel, Port St. Mary, and Port Erin. Peel is the most important of these ports. The town of Peel possesses 194 first class boats, measuring 5,044 tons; 170 of these boats are supplied with full trains of mackerel and herring nets, and represent a total capital of £750 a boat or £127,500. The 24 other boats are supplied with only a herring train, and represent a capital of £550 each, or £13,200. Peel has about 35 second-class boats, representing £200 each, or £7,000. The total capital embarked in the fishery at Peel is therefore £147,700. 1,727 men and boys are employed in the fishery. Port St. Mary, with the adjacent ports of Castletown and Port Erin, is the next most important. It contains 101 boats, representing a tonnage of 2,095 tons, with a capital of £80,800, and employing 787 men and boys. In addition, 10 boats, manned by two men each, are employed in the southern ports of the island lobster fishing, and earn £500. These boats are principally engaged in the spring and early summer in the Kinsale mackerel fishery; in the summer and autumn, in the home and Irish herring fishery; and in the winter, to a certain extent, in the long-line fishery; but they also go to Scotland and various parts of England. The earnings of the Peel boats are said to amount to—Kinsale mackerel fishery, £42,000; Herring fishery, £40,000; Long-line fishery, £1,500—total £83,500. Placing the earnings of the Port St. Mary boats at the same proportion they would amount to £40,500. The port of Douglas contains 11 first-class boats, 15 second-class boats, and 9 third-class boats, having a total tonnage of 333 tons, employing 119 men and boys, and valued at 2,800. The larger of these boats are trawlers, and work between Liverpool and the island. Ramsey has 90 boats engaged in the fishery, with a tonnage of 609 tons, representing a value of £10,306 and employing 219 men and boys. The principal fishery here is the long-line fishery for cod, which extends from the beginning of October to the end of May. In October, November, April, and May, it is conducted in small open lug-rigged boats, manned by 5 men; during December, January, February, and March, the fishery is conducted in deep sea-fishing boats, yawl-rigged, with 50 feet keel and of 50 tons burthen. The cod fishery thus occupies the time of the Ramsey fishermen for eight months out of every twelve. During the summer months four of the cod boats are engaged in fishing for conger on the west of the island, four of them go to Kinsale, while 64 boats, each manned by only one man, are engaged in fishing for mackerel. The statistics of the Ramsey fishery may be summarized as follows:—Number of boats 90; tons, 609; men and boys, 219; value £10,306. The yield of the Ramsey fishery is as follows:—1. Open cod boats, £1,560; 2. deep sea boats, £5,760; 3. Mackerel fishery, £1,344; 4. Eels, &c., fishery, £720; 5. Kinsale fishery, £1,200; 6. Miscellaneous, lobsters, &c. £300—total, £10,884. The capital, therefore, embarked in the fisheries of the Isle of Man is as follows:—1. Peel, £147,700; 2. Port St. Mary, Castletown, &c., £80,500; 3. Ramsey, £10,306; 4. Douglas, £2,800—total, £241,306. The people employed in fishing in the Isle of Man are as follows: 1. Peel, 1,727; 2. Port St. Mary, Castletown, &c., 787; 3. Ramsey, 219; 4. Douglas, 119; 5. Lobster fishing, 20—total, 2,872. The yield of the Insular fisheries may be computed as follows:—1. Peel, £83,500; 2. Port St. Mary, Castletown, &c., £40,500; 3. Ramsey, 10,884; 4. Douglas, £5,000; 5. Lobster fishing, £500—total, £140,384. In round numbers, therefore, some £250,000 is embarked in the fishery, while the returns are about £140,000 annually. Assuming that 10 per cent. is required annually to replace the capital and repay the interest on it, £115,000 is available for division among the 2,870 men and boys employed, or £1 a week for each man and boy for 40 weeks during each year. These figures do not, however, represent the whole value of the fisheries to the island. It will be readily understood that the fisheries indirectly support a considerable number of persons who are engaged as boat builders, net makers, or in other ways for supplying the fisheries; the boats which are built in the Isle of Man for the herring fishery are probably the finest and best found in the world; 700 people, at the very lowest estimate, are employed in these industries. While out of a total population of rather more than 53,000, 2,870 men and boys, representing 11,000 people, are engaged in fishing, 700 other people, men, women, girls, and boys, representing, say, a population of 2,000, are employed in industries dependent on fishing; 13,000 people out of a population of 53,900 are thus either directly or indirectly dependent on fishing for their livelihood. The Insular Government have of late years spent large sums of money in improving the harbours of the island. It is at the present moment improving the harbour at Peel, with the special object of improving the fishing industry, at a cost of £24,300; and it is constructing a new breakwater at Port St. Mary, at a cost of £15,580. Plans of these harbours are at the Exhibition. The Insular Government is also spending considerable sums of money in harbour works at Ramsey, Port Erin, and Douglas. There is no other portion of Europe, and with the exception of Newfoundland, there is probably no other country in the world where so large a proportion of the population is dependent on fishing for their livelihood. Great Britain is usually supposed to have the most important fisheries in the world. In Great Britain probably 100,000 men (say 400,000 people with their families) earn their livelihood by fishing; and one person out of about every 75 is thus dependent on the fisheries. In the Isle of Man one person out of every five depends on fishing for his daily bread, and one person out of every four is directly or indirectly dependent on fishing for a livelihood.

INDIA.

In a tropical country, such as India, the economic value of well-stocked fisheries depends greatly upon two considerations. First whether a sufficient local demand for fish exists, which will yield a fair remuneration to the fishermen for their outlay on the necessary gear and labour in securing the finny tribes. Secondly, provided such demand is insufficient, whether facilities are present which will enable them to send their surplus captures in a marketable condition to more distant localities.

Consequently it becomes necessary first to observe upon what proportion of the people of India and Burma consume fish as food, or rather are able to do so without infringing caste prejudices. In the Punjab comparatively few of the inhabitants are thus prohibited, although Brahmans and the rural population in some places reject it, but among the residents of hilly districts and towns its consumption is only limited by the paucity of the supply and the cost of the article. In the North-west Provinces, Haiderabad, Mysor, and Coorg, more than half the population are permitted by their religion to consume fish. In Oudh the majority can do so. In Sind nearly all except the Brahmans; in Bombay by far the largest proportion of the people; in South Canara 89 per cent.; in Madras the majority, the exceptions being Brahmans, Goldsmiths, high caste Soudras, the followers of Siva, Jains, &c.; in Orissa more than half the people; in Bengal proper from 90 to 95 per cent.; in Assam and Chittagong almost the entire population, and in Burma in the form of Nga-bee its use is universal.

In investigating how the local markets were supplied with fish up to 1873, the replies from native officials gave the following results. In the Punjab one in ten markets were sufficiently supplied, in the North-West Provinces one in three, in Oudh one in four. In Bombay the amount was stated to be insufficient in all and the same reports came from Haiderabad, Mysor and Coorg. In Madras, near the sea, the quantity of fish was sufficient, but only in one out of the ten inland markets. In short, merely one-tenth of the bazaars were reported as fully supplied with fish, and of these one-fifth obtained them from the sea-coast.

The fishermen in several parts of India, more especially in the Madras Presidency, have customs of a patriarchal character, which are more strictly adhered to on the Coromandel than on the Western coast, but they appear to be falling into disuse. In Madras there are three classes of headmen, the superior or priestly, whose office is hereditary, and he exercises control over large tracts of country; the next is likewise hereditary, his jurisdiction being limited to a few towns and villages. The lowest form is elective, and he is over one village or street.

The sea-fishermen in olden times are stated to have been divided into two distinct classes (1) Those who captured fish in the sea beyond their own depth; and (2) those who fished from the shore or in the backwaters, and were more immediately concerned in fish-curing and fish-vending. Remains of these two classes are still existing in Ganjam and elsewhere, but generally the deep-sea fishermen have taken to the cheaper mode of plying their occupation close in-shore.

The condition of the sea fishermen in Sind about ten years since, when investigations were made, showed that they were fairly well off; miserably poor in Bombay, except in the vicinity of large towns; in a prosperous condition from South Canara down the Western coast of the Madras Presidency, but once round Cape Comorin they again appeared as a poverty-stricken race of people and continued so up the Coromandel coast, except when residing near large centres of population.

The sea-board of India and Burma extends for about 4,611 English miles, and the seas are much more abundantly stocked with fish than are those of Europe, consequently it appears strange why the majority of the sea-fishermen should be badly off, considering the almost unlimited inland market for fish which exists. A long investigation led to the conclusion that the fisheries were in a depressed condition wherever salt was expensive or the employment of untaxed salt-earth prohibited, as in Bombay, along the Coromandel coast of Madras and the Bay of Bengal. That they were flourishing where salt was cheap or the use of untaxed salt-earth permitted, as in Sind, the Western coast of Madras and Burma. That where untaxed salt-earth could be obtained the superior quality of salt was rarely purchased for fish curing. That (with the exception of Sind and Burma) where the use of salt-earth was prohibited, the fish-curer had to dry his fish in the sun, or purchase monopoly salt, while the sole way to keep down the cost of this latter description of cured fish was to pay the very lowest possible price for the fishermen's captures and employ a minimum amount of salt. Prior to considering the incidence of the salt tax upon the fish curers' and fishermen's trade, I would draw attention to the following figures, which show, as far as returns are available, the amount of salted and dried fish *exported* by sea from Indian ports. The value is given in pounds sterling, calculating 1 rupee at 2 shillings.

Five years ending.	From Sind. Value in £.	From S. Canara. Value in £.	From Malabar. Value in £.	From Coromandel Coast. Value in £.
1857–58	8,472	No Returns.	No Returns.	Returns.
1862–63	13,064	" "	26,272	" "
1867–68	18,725	6,999	48,207	1,753
1872–73	22,944	14,921	90,849	4,513

The duty on salt in Sind has been 2*s.* a maund of 82$\frac{2}{7}$ lb. avoirdupois, sometimes less, during the entire period comprised in the above table. The first great increase in salting fish occurred in 1860—61, in which year the salt duty was raised in Bombay from 2*s.* to 2*s.* 6*d.* a maund. The next spurt of this trade in Sind was in 1864–65, when the salt duty was again raised in Bombay from 2*s.* 6*d.* to 3*s.* a maund. Possibly the importations into Bombay from Sind would subsequently have been more, but Government decided in 1867 to admit all salt fish from foreign ports, where no salt duty exists, into British India free of duty, to the immense advantage of the Portuguese settlements and the Meckran coast, but completing the ruin of Indo-British fishermen and fish-curers unless they were advantageously located.

The following table from different districts on the west or Malabar coast of Madras shows the annual sale of Government or monopoly salt, along with the value of the salted and dried fish which were exported by sea :—

Years.	South Canara.		Cannanore.		Tellicherry.		Travancore and Cochin.	
	Fish. Value in £.	Salt sold. Maunds.	Fish. Value in £.	Salt sold. Maunds.	Fish. Value in £.	Salt sold. Maunds.	Fish. Value in £.	Salt sold. Maunds.
1863—1864 . . .	1,057	191,002	96	11,653	1,459	72,505	5,416	728,268
1864—1865 . . .	3,036	168,279	219	7,932	1,504	57,516	6,052	643,897
1865—1866 . . .	875	184,174	11	9,856	194	62,135	7,061	672,370
1866—1867 . . .	1,124	151,113	12	9,728	1,825	57,381	7,337	497,988
1867—1868 . . .	875	174,629	303	8,721	2,011	56,502	7,803	558,766
1868—1869 . . .	114	176,465	520	9,045	4,319	63,340	7,130	573,639
1869—1870 . . .	2,053	147,173	4,340	8,807	5,839	72,616	6,096	574,119
1870—1871 . . .	3,927	136,967	1,470	7,932	5,301	57,624	5,833	593,389
1871—1872 . . .	2,845	177,482	695	12,008	5,340	88,674	6,987	577,268
1872—1873 . . .	5,980	135,839	951	6,985	8,429	77,332	?	?

The above table shows that the amount of annual export of salt and dried fish in Western India had very little if any connection with the quantity of monopoly salt which was disposed of, the explanation being that the people were permitted to use the salt-earth in the preparation of fish as in accordance with a legal decision the natives were free to collect this salt-earth for their own consumption. Previously three maunds of fish required 4*s.* worth of monopoly salt for its cure, but 4*d.* worth of salt-earth was found sufficient for this purpose. The article produced was inferior, but it was brought within the reach of the poor. It was proposed to impose a tax of a little more than 3*s.* 6*d.* a maund (R. 1 13 annas) on this salt-earth.

The salt tax in Madras in 1858–59 stood at 2*s.* a maund, but has been raised as follows:—1859–60 to 2*s.* 9*d.*, 1860–61 to 3*s.*, 1864–65 to 3*s.* 4½*d.*, 1869–70 to 4*s.*, 1875 to 6*s.*, but it is now again reduced to 4*s.* But in Madras some facilities are now being given to the salting of fish.

Fresh-water fisheries differ in many material respects from marine ones, and wherever any quantity of water is present in the East there we are almost certain to find fishes, and this from a sea-level to nearly the summit of the highest mountains. As a natural consequence fishing is carried on in rivers, irrigation canals, tanks, ditches, inundated fields and swamps. The fishermen of the fresh waters are divisible into two main classes; first such as follow this calling as their sole means of livelihood, and secondly such as engage in it only occasionally and as a subsidiary occupation. Of the first class, even within the limits of a single or at least of a few generations, great innovations have crept in, for in the time of native rule fishing was in the hands of distinct castes, but now it is only here and there that one comes across some remnant of these people, who still restrict their means of livelihood to this industry. British rule in most places has given up taxes on fishermen, and in many districts fishing rents as well, consequently there are few large contractors who are lessees for lengthened periods of such properties, and it is no one's business to prevent undue depletion of fisheries. In some districts the fisheries, or a portion of them, are declared free, but a licence tax is imposed on fishermen. Or the general public may take fish for home consumption but not for sale. Or liberty is given for everyone to help himself as he likes, where he likes, and when he pleases.

At first, the public, pleased at the remission of rents and the removal of restrictions, employ redoubled energy, and thus augment their immediate profits, the markets become glutted, but soon the price declines. After two or three years fish become scarcer, fishing is no longer remunerative, and the misapplied energy eventuates in nothing but small fish remaining.

Among the artificial causes deleteriously affecting fisheries in many districts are irrigation works, which are formed by throwing a weir across a river and diverting a large amount of water down a main irrigation canal. Fish migrating down rivers pass into these canals, where considerable falls exist, but they can never reascend to the river. Thus these canals become enormous fish-traps, wherein all the finny tribes are destroyed whenever the canals are run dry in order to see what annual repairs are required. Similarly all fish passing into the side channels, which are generally flooded every alternate week, become killed, as no refuge tanks are in connection with these canals. Sometimes irrigation is carried on by means of diverting entire rivers into *paddy* fields, in which case all the fry they contain perish.

As soon as young fish are moving about, or shortly after the monsoons have set in, men, women and children obtain myriads of fry from paddy fields and every sheltered spot to which they have retired for shelter and security. Nets which will not permit a mosquito to pass are employed; the sides of rivers are denuded of fish so far as human agency can contrive it. The agricultural population construct wickerwork traps, baskets and nets, first placed so as to entrap the breeding fishes ascending to their spawning grounds, and subsequently reversed to take them descending to the river. Streams are absolutely strained to capture the fry, and every irrigation channel has its wickerwork trap. These devices are too numerous to describe.

The minimum size of the mesh of the nets employed in fresh waters is exhibited in the following return :—

Return from	Size in inches between knot and knot in meshes.											
	1 inch.	Below 1 inch.	$\frac{1}{2}$ inch.	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{16}$	$\frac{1}{32}$
91 native officials.	5	5	18	5	24	1	5	18	4	2	3	1

And out of 70 more returns 53 officials compared the size of the mesh to a grain of wheat, mothi, mucca, gram-dholl, lamp-oil seed, barley, tamarind seed, a small pea, a peppercorn, a large needle, a bodkin, quill, coarse muslin, will ensnare a gnat, or hardly anything will pass.

The meshes of nets vary with the season of the year and the growth of the fish. Rivers are dammed and diverted for fishing; waters are poisoned for this purpose, and many other plans are pursued which want of space will not permit me to enumerate.

FRANCIS DAY.

CANADA.

THE Dominion of Canada (extending over half the continent of America, washed by the waters of three great oceans, and having within its confines innumerable rivers and lakes), stands almost unrivalled in the extent and variety of its fisheries.

What are generally known as the Maritime Provinces—Quebec, Nova Scotia, New Brunswick, and Prince Edward Island—have every description of sea-fishes; whilst their rivers furnish an abundance of food-fish of great economic and commercial value, and offer to the sportsman some of the best salmon and trout fishing in the world.

The great inland province of Ontario, from her vast lakes and rivers, supplies to her own people, and for export to other countries, large quantities of valuable freshwater fish; whilst the new province of Manitoba and the whole of the great North-West Territory have innumerable lakes and rivers teeming with choice food-fish, which are of great value to the settlers in that fertile region, while the rivers on the Pacific slope in British Columbia are literally full of salmon.

In a new country, where the machinery for obtaining official statistics is as yet somewhat imperfect, it is difficult to estimate with accuracy the annual value of the fish taken: besides almost every farmer and settler near the sea-coast, lake, or river, has a boat, net, or other appliances for furnishing his household with fresh fish, no return of which is made to Government. The benefit of this great boon is especially felt by the settler, who often draws from the waters within sight of his new home supplies of rich fish for his family, even after his lands yield their rich harvests. The cash value of this widely-distributed privilege to the resident in Canada cannot be reached by the statistician, as his figures deal only with commercial transactions. The export of fresh fish is principally to the United States.

Of cured sea-fish, codfish, mackerel, herring, &c., large quantities are annually shipped to the West Indies, Spain, Portugal, Brazil, and other countries. Lobster and salmon, of which about twenty million cans are packed, go mainly to the United States and Great Britain. The official returns show annually a steady increase in the value of the fisheries. In 1882 it reached the sum of $16,088,672.

In some of the older sections of Canada, the former unrestricted fishing of streams, together with obstructions by mill-dams and otherwise, so resulted in their depletion that the Government took up the matter, enacted laws for the regulation of inland fishing, provided for the erection of suitable fish-ladders or passes in mill-dams, and have established eleven fish-breeding establishments for restocking and maintaining the supply in the rivers and lakes by artificial means. The extent of fish culture in Canada, under the superintendence of Samuel Wilmot, Esq., may be judged by the output of young fish in the last season, viz:—Salmon, 5,783,000; Salmon Trout, 2,277,000; Californian Salmon placed in Eastern waters, 471,000; Speckled Trout, 40,000; Percidæ, 26,500,000; Whitefish, 20,728,000; Total, 55,799,000.

In this year's operations there have been placed in the hatcheries—Salmon Eggs, 6,612,000; Salmon Trout Eggs, 8,350,000; Speckled Trout Eggs, 200,000; Whitefish Eggs, 43,000,000; Total, 58,162,000.

To which may be added at the proper season twenty million of the Percidæ family. The total distribution of young fish since the commencement of fish-hatching operations has been upwards of *one hundred and seventy-five millions.*

Telegraph wires and cables have been laid to the principal fishing stations and harbours on the sea-coast and adjacent islands; and in addition to the ordinary signal service for all shipping, fishery bulletins are issued and immediate information given of the appearance of fish at any locality. The sea-coast, rivers, and lakes are well provided with lighthouses. The official returns of December 31, 1882, show 551 lights and 29 steam fog-whistles and automatic buoys. Seven Government steamers are employed in the lighthouse, buoy and fishery service.

The Meteorological service is very extensive and efficient, giving weather predictions at all the principal ports. During the year 1882 six thousand five hundred and forty-five predictions were issued, ninety per cent. of which were fully or partly verified.

W. D. DIMOCK, }
J. C. COLMER, } *Secretaries.*

BAHAMAS.

THE population of the Bahamas by the census of 1881 was 44,000—about 10,000 whites, the remainder blacks and coloured. The majority of the population can handle a boat, are a hardy and an adventurous race, and face any dangers in saving life and property.

The fishing-boats, numbering 100, and employing 500 men, are usually of the sloop rig, with a leg-of-mutton sail, and a well for keeping the fish alive. The sponging and wrecking vessels, numbering 500, employing 5,000 men, are of schooner rig, fine models, and fast sailers. They are built by the islanders, the timbers being of native hard wood (horse-flesh), the planking of yellow pine, from North Carolina, and vary in tonnage from 15 to 60 tons. The spongers ship on the share principle. The cost of the outfit is first deducted from the sale of the sponges, then the shipowner takes one-third, the crew two-thirds.

Fish are caught with fish-pots hand-lines, and nets, the nets being taken out some distance from the land, and hauled slowly in to the shore, when a great variety, many of brilliant and variegated colours, is usually secured. It forms an important article of food, but none are exported, with the exception of turtle (*Chelonia Mydas*), and the hawksbill (*Chelonia imbricata*), yielding the tortoiseshell of commerce.

The bait used in line-fishing is usually the conch. The fish are drummed up by striking two shells of the conch together, and are ground-baited as in English rivers. During the boisterous north-west winds prevailing between November and February, they are difficult to catch, and are brought alive in the wells of the boats, and thus sold in the market-place. The estimated value of fish used in home consumption is, £18,000 per annum, and of turtle exported £600 per annum.

King, queen, and common conch-shells are exported in large quantities, being used for cameos, and in the latter is found the beautiful pale pink pearl now becoming so valued. The value of shells exported is £1200 per annum and of pearls £3000 per annum.

Ambergris is also found on these shores, and sea-cucumber (trepang). The value of ambergris exported is £1000 per annum.

Corals and small shells, which are very beautiful, are largely collected, and find a ready sale among the American visitors and in England.

The value of the sponge exports for 1883 is estimated at £60,000. In 1882 it was £59,033. From a report by the American Consul at Nassau I extract as follows:—"That the sponge-trade gives employment to several thousands of persons and some hundreds of vessels, the sponges being divided into coarse and fine. The principal varieties, in the order of their value, are known as sheep-wool, white reef, abaco velvet, dark reef, boat, hardhead, grass, yellow, and glove; and of some of these varieties there are several grades, designated by numbers, all being used for mechanical, surgical, and bathing purposes. Bahama and Florida sponges are about equal in texture and value, but both are inferior to those of the Mediterranean. The vessels employed in sponging are small, with crews of from six to twelve men. About six weeks' provisions are taken on board, and they then coast along the banks and reefs, where the water is shallow, and generally so clear that the sponges are readily seen, and are brought to the surface by hooked poles or sometimes by diving. When first brought up they are covered with a soft gelatinous substance as black as tar and full of organic life, the sponge as we know being only the skeleton of the organism. The day's catch is spread out on the deck so as to kill the mass of animal life, which, in dying, emits a most unpleasant smell. Then the spongers go ashore and build a pen or 'crawl' of stakes close to the water's edge, so that the action of the tide may wash away the black covering, in which it is aided by pounding the sponges with sticks. When this operation is completed the sponges are strung upon small palmetto strips, three or four to a strip, which is called 'a bead,' when they are taken to Nassau to be sold in the sponge-market under certain conditions and regulations, nobody being allowed to sell his cargo otherwise than through this sponge exchange. On the conclusion of the sale the sponges are taken to the packing-yard, where they are sorted, clipped, soaked in tubs of lime-water and spread out to dry in the sun. They are then pressed by machinery into bales, containing 100 lbs., and in this state are shipped to England or the United States, which of late years is almost the largest customer for Bahama sponges. The export has been gradually increasing, for whereas in 1874 it only represented $76,500 last year it amounted to $150,000, and the year before to $168,000. A new sponge-field was discovered last year at the island of Eleuthera, sixty miles from Nassau, extending over an area of many miles, and yielding the sheep-wool, the most valuable quality. Notwithstanding this fact, there have been two drawbacks to working this field, one being, though the sponges are of a very large size, they are exceedingly tender in the inner portions, and will not cut to advantage; the other, that at certain times of the year myriads of small fish, known as 'sailors,' arrive at the field and stir up the muddy bottom to such an extent that not a single sponge can be seen."

The sheep-wool sponge brings quite as high a price in markets as the Turkish variety of the same. The success which is said to have been attained in the artificial propagation of the sponge by Professor Oscar Schmidt, of the University of Gratz, may lead to great development of this industry in the Bahamas. To the late Sir John Lees, father of the present popular Governor, the people owe a debt of gratitude for the discovery of the sponge.

In consequence of the number of islands, harbours are easily made during heavy weather, and sad cases of distress are of rare occurrence.

Several friendly societies exist for mutual aid in time of sickness.

AUGUSTUS J. ADDERLEY.

CEYLON.

THE FISHING INDUSTRY OF CEYLON.

THE seas which surround the island contain an enormous quantity and variety of fish; hardly any place in the world has been so richly endowed in this respect by nature as Ceylon.

A list of the commoner kinds of fish taken will be found in Tennent's 'Ceylon,' fifth edition, vol. i., pp. 205—232, and subsequent information on the subject will be found in Day's 'Fishes of India' (London, 1878,) Bleeker on 'Certain Varieties of Fish in Ceylon' (Leyden 1862.)

Formerly all the fisheries were a Government monopoly, and in 1840, when the monopoly ceased, the value of the fish caught was £48,210. Since that date no statistics have been obtained, but it is probable that the present annual value of fish caught is at least £150,000, and it is rapidly increasing.

A few shark fins are exported to India, and some bêche-de-mer (*Holothuria*) to China, 35 tons worth (£1200) being sent last year. Except these the only fishery products sent from Ceylon to foreign markets arise from the two remaining Government monopolies, viz.; the pearl fishery in the Gulf of Maunar, and the Chank (*Turbinella pyrum*) fishery off the north-western coast.

The former, which occurs at irregular intervals, yielded to Government £50,000 from eighteen millions of oysters in 1881, and the latter gives a steady revenue of about £400 a year from a million shells, worth about £1000; nearly all are exported to India. Both these fisheries are performed by divers, and a description of them will be found in Tennent's 'Ceylon,' vol. ii. In the same locality is found the dugong (*Halicor dugong*), a remarkable cetacean whose semi-human appearance gave rise to the myth of the mermaid.

The Maldive Islands, under the protection of Ceylon, maintain a large fishing industry and yield considerable exports. Last year they exported to Ceylon 1600 tons of dried and salted fish, worth £27,000, and a considerable quantity of tortoiseshell and cowries.

India also sent to Ceylon 2800 tons salt fish, worth £47,000.

This salt fish is used all over Ceylon as a relish with curries by the natives; and the tortoiseshell from the Maldives and Singapore is worked by native artists into tasteful jewellery which finds a ready local sale. The cowries are exported to India, where they are used instead of small coinage.

No ships of any size are used in the fisheries; the boats in use are—

Ballams, which are large logs burned or hollowed out.

Canoes, which are logs hollowed or burned out, having an artificial superstructure attached, and an outrigger.

Katamarans or rafts of logs tied together.

All these are fitted with sails, but they seldom carry more than five men.

Pada boats are of larger size and consist of two hollowed-out logs united by a plank flooring, with a plank superstructure attached. These boats will carry large nets, and as many as fifteen men.

The number of boats used in the fisheries is not less than 6400; their manufacture is peculiar, as they contain no nails, all the joints being strongly sewn together with fibre and well caulked. This fact long ago attracted the notice of the Arabian navigators, and forms the basis of one of the episodes in the story of "Sinbad the Sailor." The nets are often very large and costly, some being worth £150.

The whole of the coast round Ceylon swarms with fish. Perhaps the most productive portion is the southern coast—the south-western coast is the most assiduously fished, as the greatest population is found there. The thinly-populated coast on the north-east is fished annually by a fleet of boats which starts from Negombo, twenty-four miles north of Colombo, every year about April; the fish caught are salted on the nearest foreshore, and the fleet brings them back in October.

Dried and salted fish are universally consumed by all classes of natives all over Ceylon. Fresh fish find a ready market on the sea coast, but the want of means of quick transport inland confines their consumption to a distance of a day's journey from the coast.

The number of fishermen returned in the census of 1881 was 19,930, besides 1927 fishmongers and 334 workers of tortoiseshell.

The fishmongers are many of them hawkers who buy the fish in market as soon as the boats come ashore, and convey it inland for sale.

When all the fisheries were a Government monopoly (1796—1840) the Colonial Government used necessarily to take a more active part in their management and regulation than it does now. At present, with the exceptions already noticed, the fisheries are entirely free and untrammelled, but

Government provides market buildings at all the important fishing ports.

In 1866 the Government passed an Ordinance to prevent the wanton destruction of fish, and in 1872 another Ordinance (No. 23,) empowering village communities to make rules for the local regulation of their fisheries, of which many villages have taken advantage. The Government still appoints certain headmen who exert considerable influence amongst the fishermen.

The fishing industry is almost entirely in the hands of a peculiar caste called in Sinhalese "Karáwó," in Tamil "Karaiyar," or fisher caste, a considerable portion of which has joined the Roman Catholic Church. These continue to devote to the Church the tithe of fish which they formerly rendered to Government. Caste feeling and the influence of their priests and headmen supplies the want which co-operative and benefit societies are designed to fulfil amongst Western peoples. The fishers are all closely related. Every large net or boat, and almost every garden near the sea, is owned by several owners in common shares, and where suitable fishing ground is small in area each net in the village is registered and drawn over it in its appointed turn. The fisher caste is by no means confined to its hereditary calling; it now contains some of the wealthiest and most enterprising traders in the colony.

The most pressing want at the present time is the establishment of large fish-curing industries at the most important centres; these would in time not only render Ceylon independent of the import of dried fish, but place the colony in a position to export it, and thus give rise to a trade which would be of the utmost advantage.

The prescribed limits of this Paper preclude a detailed description of the contrivances, often very extensive and ingenious, in use for the capture of fresh-water fish on the mainland, and for the same reason all attempt to describe the remarkable peculiarities and habits of some of the local species of fish has been omitted. Some of these will be found described in Tennent's 'Ceylon.'

J. A. SWETENHAM.

GOLD COAST COLONY.

FISHERIES as to their economic value depend on quality, supply, and demand. Where a want equals the catch of the finny tribe, an industry may be viewed as healthy, whether the supply be marketable and local, or whether—which is another consideration, and one more to the point as regards this Paper—local consumption or industrial demand, or both, does not equal the catch, and as a consequence the surplus has to be and can be profitably sent to more distant markets where disposal will readily follow. In the latter case so much would naturally depend on the available means and effective conveniences of transport especially as to the disposition of fresh fish, or the effectiveness of curing where climate and circumstances put beyond consideration the transit of fresh fish. As a rule, it may be said of the tropics that fresh fish to be enjoyed must be consumed on the day of the catch. It does not always admit, indeed, of this—and the surplus captures, if energy prove sufficient for such an issue, are cured and sent to inland markets that offer.

My remarks are meant to apply to the Gold Coast Colony, where the people may be described as a fish-eating population, and where caste prejudices do not exist. Fetish restrictions may be at times, but rarely, imposed on the catch or consumption of this article of diet, but charity begins at home even with the Fetishman—who is often a fisherman, and, when not, is the recipient of "dashes" from the sea in the shape of fish by the propitiators of the sea-god; thus he would not be so shortsighted as to impose any restrictions on so needful and essential a commodity, especially when he would know that, were he to do so, his power of imposing obedience might be jeopardized by seafarers.

In a country where local demand keeps pace with the population, and where the cost of fishing gear is comparatively trivial when it is remembered that the value of time is not yet known, so that the estimate of labour in the computation of outlay on appliances is not of much moment, the question of supply may be said to be favourably met; whereas to the demand the sale market is large and wide enough, representing, as it does, a huge interior, but a clammy and damp, at the same time hot climate, bad roads, no other means of transport but in baskets on the heads of natives, imperfect system of curing, stand forth as obstacles, and indeed great ones, towards the development and growth of a healthy inland fish traffic.

Philanthropic and scientific expeditions undertaken at various times in the past point to the fertility of the Eastern Atlantic as a fish-bed, but it is evident that sufficient advantage, compared with the fruit to have been reaped, has not been taken of nature's bounty; and as regards West Africa, a comparatively new and scientifically unknown region, other mercantile and more popular attractions and manias have caused the fish industry to be now what it was a hundred years ago, aye more *ab initio* the primitive calling and promotion of the aborigines in whose hands it has been and is, but towards whom more interest of a practical nature should have been, and it is to be hoped will be, directed in the matter, at least, of the improvement of the system of catch and healthy supply.

No approximate value of the fisheries can be given.

Data are not forthcoming. The population of the Gold Coast cannot, it would seem, be got within the range of "practical statistics." It will be ideal to state that most of the people, estimated in round numbers say at 400,000, live chiefly on fish, so that some conception can be formed of the considerable catch there must be annually to supply such a mass, as also the great unlimited interior markets beyond our jurisdiction.

The Gold Coast Colony—prior to the following date made up of the settlements on the Gold Coast and the settlement of Lagos—comprises, according to Letters Patent of 22nd January, 1883, all places, settlements, and territories belonging to Her Majesty the Queen, in West Africa, between the 5th degree of W. Long. and the 5th degree of E. Long. It must not be understood that the colony is one and undivided, for a strip of coast and country commonly known as the Dahomean sea-board and territory intervenes.

The population of the Gold Coast has, as already stated, never yet got beyond an estimate. Lagos was, however, more favoured, for in 1881 the census effort there applied gave its population as 75,270, of whom 5,695 were returned as fishermen.

Against the consumption of locally-caught fish, it may be interesting to have, by way of comparison, the value of imported fish, which I give for two years :—

Year.	Value of Fish imported. Gold Coast.	Value of Fish imported. Lagos.	Value of total imports. Gold Coast.	Value of total imports. Lagos.
	£ s. d.	£ s. d.	£	£
1880	No Statistics.	576 9 0	337,248	376,215
1881	248 1 11	273 15 8	398,123	336,659

There has been no exportation of fish—naturally. Imported fish, which is brought mainly from the United Kingdom, Germany, and America, is chiefly represented by tinned and smoked salmon, lobster, sardines, salt cod and ling, red herrings, and mackerel; and is supplied to meet the taste of Europeans and Europeanized natives. The aborigines, as a rule, prefer their own fish.

The fishing craft of the colony is represented altogether by the canoe, "the dug-out," of varying sizes, regulated by the number of persons carried, viz. from 1 to 5. Canoes most frequently used are those for three persons; they are propelled by paddles, the shapes of which vary tribally, the occupant (or occupants) resting on his knees, on his haunches, or standing erect.

Sea fishermen usually pursue their avocations in the day; they rarely work at night; but to this rule there are exceptions, while in the lagoons freshwater fishing is conducted at times both day and night.

Edible oysters are found both in beds, on the rocks running out into the sea, which are uncovered at low tide, and on trees (the mangrove).

The curing of shrimps and herrings forms a large industry, and represents a considerable trade within the colony and beyond its border.

The people suffer much from cutaneous diseases and ulcerations, which are attributed to the condition of the fish diet on which they, as a rule, have to depend. The primitive and defective system of curing must lose after a time its efficacy, and thus deleterious effects have been traced to imperfect or bad curing of fish, such as herrings, which the natives of the Gold Coast Colony principally consume.

The following general nomenclature, taken from blue books and other records, is given of (1) the fish, (2) crustacea, and (3) molluscs caught:—

(1) Albicore, bonito, barracouta, bream, catfish, flying-fish, "grouper," herring, "jo," mullet, mackerel, "shinenoze," skate, snapper, sole, sword-fish, sprat, turbot, whitebait, electric fish.

(2) Shrimps, crabs, lobsters.

(3) Oysters, mud, rock, and mangrove.

Different species of sharks abound. The manatee is also plentiful.

Operations for the capture of the different forms of marine and freshwater life are conducted as a general rule by canoes, and effected by the following means—Miniature models of the fishing gear, collected and presented by the writer, are to be found in the Western Gallery of the Exhibition.

1. Fish traps, bamboo baskets.
2. Drag nets of pine apple or other fibre.
3. Hand nets of pine apple or other fibre.
4. Shrimp baskets of split bamboo.
5. Shrimp or freshwater shell fish net.
6. Matting or bamboo grating for encircling shallow ground and for entrapping fish.
7. Manatus trap.
8. Kroo canoe, for one.
9. Hand nets corresponding with our landing nets.
10. Native fishing pot.
11. Native water scoop for baling purposes.
12. Native-made (of fibre) fishing line.
13. Whips made of the skin of the manatus.
14. Hand trawl net.

The introductory object of this memorandum, and want of space and time, will not permit me to dwell here at further length on a subject of such interest and importance generally, but particularly so to the natives of the West Coast of Africa.

ALFRED MOLONEY.

HELIGOLAND.

THE fishing industry of Heligoland is carried on by a fleet of open boats which consist of:—

Description.	No.	Length.	Beam.	Depth.	Draft of Water.	Value.	Remarks.
		feet.	feet.	feet.	feet.	£	
Sloops . . .	31	31	9	5	2·3	250	Model in Exhibition.
Rudder Boats .	18	28	7	3	1½	125	
Middle Boats .	21	24	6	2½	1½	90	
Lobster Boats .	114	18	5	2	1	27	

All these boats are built entirely of oak, and are flat-bottomed, to enable them to be beached, and are sailed with lee boards.

Rig.—The sloops are rigged with sprit sail and fore sails with two jibs; as they carry no bowsprit, a spar is used temporarily for setting the jib, and when running free this spar is rigged out on the beam with the jib set on it. They all carry eight days' provisions and water, two anchors, a hemp cable, and from 7 to 9 cwt. of stone ballast. In case of the weather being too bad for them to get back, they anchor, take the mast down, and thus ride out the heaviest gale, one man constantly baling. The other boats are all rigged with standing lug.

Gear.—The fish is caught entirely by line; every sloop carries from 15 to 22 lines, each of 40 fathoms with 40 hooks. The lines are shot across the stream; the first line is secured to an anchor, which is buoyed; the boat then stands across, veering the lines as she goes, each line being bent to the next, and each line having a small anchor to take it to the bottom, and keep it there. When the end of the last line is nearly out, the boat anchors, and after a time weighs and works towards the buoy, hauling the lines in as she goes. The bait is usually sand eels, which are principally got on "Sandy Island," three-quarters of a mile from the main island of Heligoland.

Formerly the fishing fleet consisted of nearly a *hundred* sloops, but by constant losses through gales it has dwindled down to the present number, of which but 27 are now fit for sea.

Seasons.—There are two fishing seasons, from March to the end of June, and from October to about January, *i.e.* when the weather necessitates the hauling up of the boats. The fish caught is almost entirely haddock, with a few cod and an occasional turbot.

Winter.—In the winter the fishing is carried on in company. The fish is brought to the island and delivered to an agent, who has it cleaned and packed, to be forwarded by steamers, which are sent over on receipt of telegrams by the contractor on the continent. This autumn fishing for the last five years has yielded an average of 171,000. The highest year was 1880, with 368,700 haddock and 1,266 cod; the lowest 1881, with 58,300 haddock and 154 cod, calculated at *seven* score the hundred, the average price paid by the contractor during the above period being £1 3*s.* per hundred (140) haddock and cod 1*s.* each.

Spring Fishing.—In spring the boats generally take their own fish to such markets on the opposite coasts, often from the fishing grounds themselves; it is therefore very difficult to arrive at a correct calculation of the season's catch, as well as to estimate the total sum realized, no data having been kept. Prices, however, I find vary from 15*s.* to £3 10*s.* per seven score.

Summer.—In summer there is little or no fishing carried on beyond what is needed to supply the wants of the restaurants, &c., most of the fishermen being employed in the ferry which takes the visitors over to bathe at Sandy Island, and in boating along with the guests.

Lobsters.—From 20,000 to 30,000 lobsters are collected annually on our rocks, the close season being from the 13th June to the 13th September. These are stored in lobster boxes containing often as many as 200 each, the fish being either for local use, or are sent to the Continent, where Heligoland lobsters are greatly prized. It is estimated that to obtain these results 4000 lobster pots (model to be seen with sloop) are in use, value about 4*s.* each. The heavy gales to which we are so subject do great injury to these pots, so that the occupation is not so remunerative as it would seem. The average price realized for lobsters per lb. is from 7⅕*d.* to 1*s.* 6*d.*

Oysters.—The Heligoland Oyster Bank is let to a contractor; it is fished from September to March by the sloops, aided by rudder boats, on a bank about three miles to the eastward of the island, dredges being used. It has yielded but 130,000 of late years, mainly owing to disagreements between the contractor and the fishermen. The price paid is seven marks per thousand delivered to the contractor's agent in the island.

Fishing grounds.—The Haddock fishing grounds are from the N. through W. to S.E. of the island at from eight to forty miles from it.

The lobsters are caught on the reefs that extend N., S. and W. of the Main and Sandy Island to a distance of about four miles.

Use of fish.—The Heligolanders live almost entirely on fish, a meat meal being of rare occurrence. Fish is not used as manure, neither is it cured for export or for sale.

Fishermen.—By last census there were 307 returned as fishermen; the entire population, however, could be almost included (out of the bathing season) in this category, as old men and children aid in preparing lines, &c., which are cleaned, carried, and baited by the women.

Colonial aid.—No special action in aid of fishermen on the part of the Colonial Government is possible in the present impoverished state of its finances.

Benefit societies.—When our fleet was nearly destroyed in 1878 a subscription was started in Germany in aid of the fishermen, which realized £1535; from this loans without interest were given to the sufferers. The balance with the interests thereon, and the repayments as above, amounts now to £840, which sum is allowed to accumulate till it reaches £1000, when it is to form the capital of an assurance fund or benefit society started at the same time, to aid in repairing future disasters; to it the fishermen contribute:—

Autumn fishing: for each 100 (7 score) of fish, 1 M. = 1 shilling; 100 oysters, 5 Pfennige, about $\frac{3}{5}$*d.*

Spring fishing: each sloop, 15 shillings; each rudder boat, 12 shillings; each middle boat, 8 shillings; each lobster boat, 4 shillings.

The amount subscribed up to date is £460 10*s.*; the amount spent in particular aid, £452 10*s.*; in hand, £8.

Should the society dissolve, then the money is to be divided among the subscribers, with the exception of the capital of £1000, which is to remain for ever at interest for the benefit of old fishermen and their widows.

Final remarks.—Though the waters of the North Sea abound in fish, and often fleets of hundreds of English, German and Dutch smacks are in sight of the island, the Heligolanders, though yielding to none as fishermen, cannot participate in the riches which God has brought to their door, for without a harbour they can but use vessels such as can be hauled up in bad weather, and therefore such as preclude them from going far to sea to earn their daily bread.

T. O'BRIEN, Lieut.-Col.,
Governor.

JAMAICA.

THIS island is situated in the Caribbean Sea, and to the southward of the eastern extremity of Cuba, within N. latitude 17° 40′ and 18° 30′: it is 140 miles long, 50 in extreme breadth, and contains 4200 square miles. The population by the last census (1881) was 580,804, of which 14,433, were whites.

The waters of Jamaica abound in excellent fish, but its fisheries are not utilized to any extent. The best illustration of this fact is that the importation of cured fish amounts annually to £200,000, whilst the take of fresh fish at their doors is only £30,000 per annum.

The Jamaica Institute, with the view of developing these resources, and making the people more independent and self-supporting, and stimulating fish curing, are offering prizes for specimens. There is not much enterprise, however, shown at present, although the fisheries are capable of easy expansion. The number of boats and canoes employed is about 1000, and of men 3000.

Turtles (*Chelonia Mydas*) are exported alive, and sun-dried, and tortoise-shell from the *Chelonia imbricata.* They are mostly caught at the Cayman Island and the Morant and Pedro Cays. The exports of turtle amount to £1000 per annum, of tortoise-shell, £2000 per annum. The latter is manufactured into ornaments and useful articles in the colony.

The principal salt-water fishes are:—The Calipeva or Jamaica Salmon, June fish attaining the large size of 200 to 304 lbs.; Hog-fish, Angel-fish, Dolphin, Porgee, Grouper, Sun-fish, Grunts, Croakers, and Drummers ; all the three last deriving their names from the sounds they utter when caught ; Snappers, Silts, caught at 200 fathoms in depth ; King-fish, Barracouta, and many others which limited space will not admit of naming. Of fresh-water fish, the best are: Mountain Mullet, Crayfish, Silver Eel, Mud-fish, &c.; and in brackish waters, Jew-fish and Calipeva. Fish are caught with lines, fish-pots and the seine. The price varies from 1½*d.* to 6*d.* per pound. Reference is suggested to the handbook of Jamaica, and an interesting paper thereon by Anthony Musgrave, Junr.

Most of the Jamaica fishes are represented in preserved form, either in alcohol or stuffed, grouped in various parts of the Court. The entire collection has been loaned by the Jamaica Institute.

A. J. ADDERLEY.

NEWFOUNDLAND.

THIS island is situated between the parallels of 46° and 50 north latitude and the meridians of 52° and 59° west longitude, at the mouth of the Gulf of St. Lawrence, and has an area of 42,000 square miles, with a coast line of over 2000 miles.

It has also belonging to it the Labrador territory, with a coast line of nearly 1000 miles.

Newfoundland is the oldest colony of Great Britain, having been discovered in 1479; it is also the nearest to the United Kingdom, being but 1640 miles from the Irish coast.

Along all these coasts are the celebrated fishing grounds to which the fishermen resort in pursuit of their avocations.

The island has, besides, very valuable and extensive mineral resources, which have but recently been brought to light, but which promise to become an important source of industry and wealth. The principal of these are copper and lead; and when the country is opened up, by means of the railway now in course of construction, it is the opinion of the best scientists, that Newfoundland will take a leading place among the mineral countries of the world.

PRESENT VALUE OF THE NEWFOUNDLAND FISHERIES.

The principal commercial fishes taken from the waters around Newfoundland and Labrador are the Cod, the Seal, the Herring, the Salmon, and the Lobster. The quantities of other fish taken are too small to render them of commercial importance.

THE COD FISHERY is by far the most important, its products averaging in value three-fourths of the entire returns of the fisheries.

The following statement shows the values of the Cod fishery products for the years named:—1880, exported, $5,309,484, consumed in the colony, $408,000; 1881, exported, $5,542,576, consumed in the colony, $384,000; 1882, exported, $5,978,668, consumed in the colony, $480,000. Total exported, $16,830,728; Total consumed in the colony, $1,272,000. Total value in three years, $18,102,728, or £3,771,402 sterling. Average annual value of the products of the Cod fishery for the last three years, $6,034,242, or £1,257,134 sterling.

The following statement shows the value of the Codfish taken by the French on that portion of the Newfoundland coast over which their fishing privileges extend, and is exclusive of their bank fisheries:—1880, $250,920; 1881, 342,588; 1882, 244,800. Total, $838,308. Average annual value, $279,436, or £58,216 sterling. The products of the Cod fishery above referred to, include the dried Codfish exported, the common Cod Oil, the refined Cod Liver Oil, the roes exported for bait in the Sardine fishery, and the dregs. The Cod Oil is chiefly exported to Britain, where it is found peculiarly valuable in dressing leather. The refined Cod Liver Oil is used for medicinal purposes.

The following statement shows the quantities and value of these products respectively, for the years named:—1880, Dried Codfish, 1,419,503 quintals (112 lbs.), $4,826,317; Cod Oil, 4483 tuns, $448,300; Refined Cod Liver Oil, 172 tuns, $30,960. 1881, Dried Codfish, 1,583,132 quintals,

$5,066,022; Cod Oil, 4127 tuns, $445,716; Refined Cod Liver Oil, 144 tuns, $25,920. 1882, Dried Codfish, 1,463,439 quintals, $5,853,756; Cod Oil, 4,254 tuns, $493,464; Refined Cod Liver Oil, 147 tuns, $28,224.

SEAL FISHERY.—The Seals are taken by the crews of steamers and sailing vessels on the ice fields off the north-east coast of the island, and in the Gulf of St. Lawrence, during the months of March and April.

The following statement shows the number of Seals taken and their value, in the years named:—1877, 451,678, $1,116,360; 1878, 409,658, $1,006,568; 1881, 447,903, $957,760. Total number of Seals, 1,309,239. Total value, $3,080,688, or £641,810 sterling. Average number of Seals taken in three years, 436,413. Average annual value of Seals taken in three years, $1,026,896, or £213,937 sterling.

The products of the Seal Fishery include the Skins and Oil. The former are exported in a salted state to Britain where they are tanned or used by furriers. The Seal Oil, extracted by steam process, is sent to Britain, where it is largely used in coal mines for illumination, also in light-houses. It is also used in the manufacture of the finer kinds of soap and candles.

The following statement shows their respective quantities and values in the years named:—1877, Seal Skins, 451,678, $361,342; Seal Oil, 6081 tuns, $754,044. 1878, Seal Skins, 409,658, $286,760; Seal Oil, 5992 tuns, $719,040. 1881, Seal Skins, 447,903, $403,112; Seal Oil, 4773 tuns, $553,668.

HERRING FISHERY.—Herrings are taken all round the island at certain seasons, but the chief centres of the Herring Fishery are Labrador, Bonne Bay, Bay of Islands, St. George's Bay, and Fortune Bay.

Statement showing the value of Herrings exported in the years named:—1880, $226,946; 1881, $269,556; 1882,

$228,128. Total, $724,630. Average annual value of Herrings exported in three years, $241,543. Average annual value of Herrings taken by the Newfoundland fishermen, and sold to the French and Americans as bait or for food, $100,000. Average annual value of Herrings consumed in the Colony, $240,000. Average annual value of the Herring Fishery, $581,543, or £121,155 sterling.

SALMON FISHERY.—Statement showing the value of Salmon exported in the years named:—1880, $138,904; 1881, $80,348; 1882, $124,264. Total, $343,516. Average annual value in three years, $114,505, or £23,855 sterling.

LOBSTER FISHERY.—Statement showing the value of Lobsters exported in the years named:—1880, $95,712, 1,124,580 lbs. 1881, $111,408, 1,346,240 lbs. 1882, $105,432, 1,265,224 lbs. Total, $312,552, 3,736,044 lbs. Average annual value of Lobsters exported in three years, $104,184 or £21,705 sterling. Average quantity taken in three years, 1,145,348 lbs. Estimated annual value of all other fish taken, $40,000.

RECAPITULATION.—Average annual value: Cod Fishery, $6,034,242; Seal Fishery, $1,026,896; Herring Fishery, $581,543; Salmon Fishery, $114,505; Lobster Fishery, $104,184; all other Fish, $40,000. Total average value annually of the Fisheries, $7,901,370, or £1,646,118 sterling.

COUNTRIES TO WHICH THE FISH ARE EXPORTED.—The countries to which the bulk of the dried Codfish is exported are the United Kingdom, Brazil, Portugal, Spain, the United States, Italy, Spanish and British West Indies, and the Dominion of Canada. The products of the Seal Fishery are sent almost exclusively to the United Kingdom. Lobsters are exported to Britain, and Herrings chiefly to Canada and the United States.

EXPORTS.—The following statement shows the total value of the Exports of the Colony for the years named:—1880, $7,131,095; 1881, $7,648,574; 1882, $8,228,291. Average annual value of Exports for three years, $7,669,320, or £1,597,775 sterling.

In the foregoing Exports are included quantities of Copper Ore exported, the value of which was as follows:—1880, $510,900; 1881, $596,068; 1882, $382,020. Average annual value of Copper Ore exported in the three years, $496,329, or £103,402 sterling.

SHIPPING.—The registered tonnage of the Colony at present is 1895 vessels, having a tonnage of 89,655 tons; of these 1866 are sailing vessels and 29 are steamers. In addition, 60 vessels were engaged in 1882 in the foreign carrying trade, which though owned in Newfoundland, were registered in Britain.

The number of sailing vessels entered at the various ports in 1882 was 1306; their tonnage 160,887 tons; their crews numbered 7840. The number of sailing vessels cleared at the various ports in 1882 was 1107; their tonnage 143,720; their crews numbered 7200.

The number of steamers entered at the various ports in 1882 was 191; their tonnage, 150,107; their crews numbered 6758. The number of steamers cleared at the various ports in 1882 was 176; their tonnage 147,784; their crews numbered 6568.

NUMBER OF FISHERMEN.—According to the census of 1874 there were 45,845 persons employed in fishing and curing fish. In 1883 there are about 52,550 thus employed, allowing for the increase of the population. The number of able-bodied fishermen in the Colony in 1874 was 26,377; there are now about 30,238.

A bounty of three dollars per ton is granted to all vessels over fifteen tons built in the Colony.

Fishermen have a first lien on the products of each season's fishing operations for wages or shares.

The following statement shows the extent and value of the French Fisheries on the Banks and on the Coast of Newfoundland in the years named :—

Year.	Men.	No. of Vessels.	Tonnage.	Qtls. of Codfish taken. (112 lbs.)	Value.
1878	7858	181	30,350	321,411	£285,673 sterling.
1879	7168	177	27,865	369,628	279,697 „

NEW SOUTH WALES.

THE following introductory remarks are taken from the Special Catalogue of the New South Wales Exhibits :—

"The greater portion of the exhibits in the N. S. Wales Court have been liberally supplied by the Trustees of the Australian Museum, at the request of the Commissioners N. S. Wales Fisheries, having been specially prepared by the skilled taxidermists of that institution, the Commissioners themselves undertaking, through their energetic Secretary, Mr. Lindsay Thomson, the preserving of the tinned fish and oysters, and procuring from the various beds the large and interesting collection of Oysters displayed in the Court, as well as the fishing-boat, nets, and lines, the fish-oils, the photographs and oil paintings of the food-fishes, with many other interesting articles mentioned in the Catalogue.

"The notes appended to each of the different samples of Oysters have been collated from the reports sent with each to the Commissioners by the Inspectors and sub-Inspectors of the various leased beds in the colony of New South Wales.

"One of the most marked features in the fish-fauna of the Australian seas is the almost entire absence of the Cod tribe (*Gadidæ*), a family among which the Codfish itself, the Ling, the Haddock, the English Whiting, the Hake, &c., supply such immense quantities of valuable food, and afford so much employment to thousands of human beings in the Old and New Worlds. This want is, however, amply supplied by members of other families, such as the Mugillidæ, Sciænidæ, and Carangidæ, which visit the Australian shores in vast shoals. From among these fisheries might be formed, which, if carried on under efficient management, experience, and skill, with a comparatively small expenditure would in the future bid fair to rival the largest and most important in the world. Unfortunately there are at present no fish-curing or canning establishments in New South Wales.

"With the exception of one species, *Retropinna richardsonii*, Gill, a species not used for food, the Salmonidæ are naturally absent, but this family has been so successfully introduced into the Tasmanian waters, that it is highly probable, ere long, even Salmon will form an important article of export.

"With regard to the Clupeidæ (the herrings, pilchards, sprats, and anchovies), the species of this family are very numerous, and occur in quite as large shoals as in any other part of the world.

"When the Mugillidæ, the most valuable for canning purposes, but which only occur at a certain season of the year, are gone, there are many other families the members of which are also found in immense quantities, for instance, the Sciænidæ: *Sciæna antarctica* and *Otolithus atelodus;* the Sparidæ: *Chrysophrys australis, C. sarba, Girella tricuspidata, G. simplex,* and *Pagrus unicolor:* the Carangidæ: *Seriola lalandii, S. gigas, S. grandis, Temnodon saltator:* the Scombresocidæ: *Hemirhamphus intermedius* and *H. regularis;* the Scombridæ, which include the mackerels: *Scomber australasicus, S. colias, Thynnus pelamys;* the Trachinidæ; *Sillago ciliata, S.*

bassensis—all of which occur at various seasons of the year, and, being obtainable in large quantities, would afford lucrative employment to hundreds of men, women, and children, and food for thousands.

"Moreover with more experience and knowledge of the proper trawling-grounds, still further sources of supply will arise.

"At present, a great difficulty is the proper preservation of fish after their capture for transit inland and elsewhere. This arises from the heat of the climate, the scarcity of ice and the want of efficiently constructed and swift boats for transit. Doubtless such wants will in due course be remedied, as the demand for fish-food is daily on the increase.

"The fishing industry as yet may be regarded as in its infancy. This is shown by the fact that the only nets in general use by the fishermen are the ordinary trawling seines and mashing nets, while there is only one style of boat, a model of which is exhibited in the Court.

"It may not be out of place here to draw attention to some of the principal features of the New South Wales Court, among which may be eumerated the large Sunfish, *Orthagoriscus*, sp., the Luth, *Dermatochelys coriaceus*, the group of Péron's Seals, *Otaria cinerea*, exhibited for the first time in England and Europe, the large collection of food-fishes, stuffed and in spirits. The Sponges and Oysters deserve attention, while the walls are decorated by life-sized oil-paintings of fishes and large photographs of the fish-markets and certain of the Government offices and other magnificent buildings, highly creditable to Mr. James Barnet, the colonial architect."

New South Wales exhibits chiefly a large collection of the

Fishes of the Colony preserved in spirits. These are all *food fishes* and such as from time to time at various seasons of the year find their way to the fish markets. The number of species exceeds 150 kinds, and are represented by 300 specimens. The freshwater species, such as the Murray Cod, and various kinds of Perch and Bream, Herring, &c., are well represented. A catalogue now in preparation, and which will be ready for distribution in a few days, contains a detailed list of these fishes (*see Special Catalogue of the New South Wales Court*) and also notes on a fine collection of Sponges from Port Jackson and the adjacent coast. A collection of *Echinodermata* and *Crustacea, zoophytes*, &c., and Polyzoa from the same localities. A group of Eared Seals *Arctocephalus cinereus*, consisting of adults and young, is exhibited on the left of the entrance to the Court. Two well prepared specimens (male and female) of the Dugong, *Halicore australis*, and oil and lard obtained from these strange animals, are also exhibited. In the side cases are exhibited, besides the stuffed-fish, a large collection of *Oysters*, of sixty varieties, from different leased beds in New South Wales. There is also a collection of other edible Mollusca, such as the Turbo, Staliotis or Mutton fish, Cardiums, &c., &c. The walls are decorated with oil-paintings of the principal food-fishes and numerous photographs of Australian scenery and public buildings. Fish oils are represented by the oils obtained from the Grey Mullet, and various species of Sharks and Ray, of which stuffed specimens are also exhibited. The collections are chiefly of a scientific nature, but the numerous kinds of fishes show that large fisheries are capable of being developed in the Australian waters, particularly of the Grey Mullets, Herrings, Schnapper, and the Murray Cod and Perch. Other exhibits, consisting of Preserved Fish of several kinds, and Oysters in tins, are exhibited on the eastern side of the Court.

The so-called "Murray Cod" or "Macquarie Cod" (*Oligorus macquariensis*) is the largest of our freshwater fishes, sometimes weighing over 100 lbs. When at a weight of from 3 lbs. to 10 lbs. it is considered most marketable, and is without doubt a most delicious fish. It abounds in most of the rivers north of Sydney, and in those of the western watershed, as the Murray and Macquarie, and their numerous tributaries, affording good sport for anglers and a valuable supply of food; they are usually taken for market with the Trammel, or Bag-net, set across the stream, or by hook and line. They have also been introduced into several of the inland lakes nearer Sydney, such as Lake George, Lake Bathurst, &c., where they thrive remarkably well, becoming immense fish and exceedingly fat. A large specimen, which weighed about 20 lbs., is exhibited in front of case No. 3.

Large quantities are daily, during the cold months, sent to the Melbourne and Adelaide markets from the Murray and its numerous tributaries; the supply for the Sydney markets is obtained from Lake George and from the Macquarie River, but chiefly from the Murrumbidgee, being forwarded by train from Wagga.

Two species of Murray Cod are recognised by naturalists: the *Oligorus macquariensis*, Cuv. et Val., and *Oligorus mitchelli*, Castlenau.

The next fishes of importance, all of which are considered great delicacies, are the Golden Perch, *Ctenolates ambiguus* (*Dules auratus*, Richardson), *Ctn. chrysti*, Cast., and *Ctn. flavescens*, Günth. *C. ambiguus* is found in considerable numbers in the Victorian fresh waters and at Wagga on the Murrumbidgee. *C. flavescens*, equally plentiful, is, I believe, confined to the upper waters of the Macquarie, in New South Wales; here we also have the silver perch (*Therapon Richardsoni*, Cast.) and *T. macleayana*, Ramsay, in considerable numbers, although usually taken for the markets with the net, they afford good sport to the angler. From twenty to forty fine fish, weighing from ½ to 6 lbs. weight, may easily be secured by one person in a day's fishing within a few miles of the town of Wellington.

Among other fishes equally good may be mentioned *Therapon niger*, Cast., *Murrayi Güntheri*, Cast., *M. cyprinoides*, Cast., *M. bramoides*, Cast., *Riverina fluviatilis*, Cast., *Macquaria australasica*, Cuv. et Val., and others which occasionally find their way into the southern markets.

Lates colonorum of Günther forms a palatable article of food; it inhabits most of the rivers, lakes and lagoons throughout the whole of Australia, but is replaced in the northern rivers by a much larger species known as *Lates calcarifer*, which is there more abundant.

L. colonorum is not unfrequently taken with nets in the bays at the estuaries of the rivers, having been brought down the rivers by the "freshes" or floods, also by "set" nets in the rivers higher up the stream. When freshly cooked are among the best of our river-fishes. They spawn during August and September, the roes being considered a great delicacy. There are many other species, such as *Lates ramsayi*, MacLeay, *Lates curtus*, Cast., *Mugil dobula*, Gth., *Mugil argenteus*, Eels, *Anguilla australis*, the freshwater Herring, *Meletta novæ hollandiæ*, the cat-fish *Copidoglanis tandanus*, and a host of small fry which afford the anglers pleasant sport as well as a good dish.

But the most important of our freshwater fishes are undoubtedly the two species of the Murray cod (*Oligorus*), the golden perch (*Ctenotales*), 2 species, the silver perch, and the MacLeay's perch (*Therapon*), and the river perch (*Lates*), 2 species, with the eels, (*Anguilla*), of which there are also probably 2 species.

E. P. Ramsay.

SAINT LUCIA.

CATALOGUE OF THE PRINCIPAL FISHES.

Names.		Length.	Weight.	Locality.	Commercial Quality.
French and Patois.	English.				
1. Ton	Albicore	3½ ft.	150 lbs.	Deep Sea.	Good for Corning.
2. Vieille	Grouper	3 ,,	100 ,,	,,	Too fat for do.
3. Varie		8 ,,	300 ,,	,,	Good for do.
4. Tazza	King Fish	5½ ,,	45 ,,	,,	Too fat for do.
5. Reelay	King Fish (2nd)	9 ,,	80 ,,	,,	Not good for do.
6. Requin	Common Shark	19 ,,	500 ,,	,,	Never corned.
7. Pantouffe fouillé	Shark (2nd)	Much dreaded.		,,	Scarcely eaten.
8. Dorade	Dolphin	5 ,,	80 ,,	,,	Fat, but cornable.
9. Bonique	Bonito	2½ ,,	10 ,,	Deep and Shore.	Good for corning.
10. Vivaneau	Red Fish (1st)	3 ,,	16 ,,	,,	Do. do.
11. Boucan-nègre	Red Fish (2nd)	3 ,,	12 ,,	,,	Do. do.
12. Grand-yeux	Red Fish (3rd)	5 ,,	25 ,,	,,	Not good for do.
13. Tête ronde	Red Fish (4th)	2 ,,	12 ,,	,,	Good for corning.
14. Càrrengue grasse	Cavally (1st)	2 ,,	10 ,,	Shore.	Not good for do.
15. Do. Cammade	Cavally (2nd)	3 ,,	15 ,,	,,	Good for do.
16. Do. Noire	Black Jack	2½ ,,	12 ,,	Deep Sea.	Too fat for do.
17. Becune	Barracouta	10 ,,	40 ,,	,,	Not good for do.
18. Massoin	Porpoise	5 ,,	150 ,,	,,	Do. do.
19. Haut-bouieille		7 ,,	150 ,,	,,	Too fat for do.
20. Argente		2 ,,	12 ,,	,,	Good for do.
21. Larie	Sting-a-ray	2 to 3 ,,	20 ,,	,,	Never corned.
22. Grand' écaille		2½ ,,	20 ,,	Shore.	
23. Zophie	Ocean Gar	2 ,,	3 ,,	Deep Sea.	
24.	Spanish Mackerel			,,	
25. Sob		2 to 3 ,,	25 ,,	,,	Good for corning.
26. Pag		1½ ,,	10 ,,	,,	Do. do.
27. Sol	Flounder	1 ,,	2 to 3	Shore.	
28. Wattalibbi	Butter Fish	9 in.		,,	
29. Saumon	Salmon	2 ft.	10 ,,	,,	
30. Coulirous	Jack Fish	9 in.		,,	
31. Balahou volant	Flying Fish	9 ,,		Deep Sea.	

NOTES.

No attempt is made to give a list of the smaller kinds of fish. Their number is legion, and their colours often varied and very brilliant; but the flesh is coarse.

Of the larger kinds, the grouper, the king fish (Tazza), the cavally (Carrengue grasse), the black jack (Carrengue noire), and the barracouta, are considered the finest for the table. Among the smaller ones, the butterfish is an excellent and delicate morsel. So is the Spanish mackerel. Flying fish and jack fish are good eating, and likewise the rock hind.

To these may be added the hedgehog and eels; and among shell fish, sea eggs, oysters and whelks.

Turtle, of two species, are fairly plentiful.

Whales, chiefly the hump backs, are pretty common from January to May, and are fished by Americans.

Among freshwater fish, there is the mullet, resembling the trout in size and delicacy of flavour. Then come the carmeau, the brochet, the vermine, the endormeur, and the sarde-dents-chien. One or two of these attain sometimes large proportions, the carmeau, for example, reaching three or four feet, and weighing 30 lbs., and the sarde-dents-chien 60 lbs. These are to be found in the deep pools near the mouths of the rivers.

In these islands, "pickling" fish is not practised, and "corned" fish is the term used for the local fish when salted and dried. "Salt-fish" is the name given to the imported Newfoundland cod. The drier kinds of fish, when corned, will sometimes last quite as long as the "salt-fish."

The sizes and weights given in the catalogue express the largest dimensions known to the persons who have contributed to the information herein given, some of whom are practised fishermen.

Most of the deep sea fish are caught by the hook and line. Flying fish are caught in net-bags attached to a stick, and dipped beside the boat. Cavallies, jack fish, and others are taken in large seines, which are drawn upon sandy shores. Many of the smaller kinds are taken in fish-pots, weighed and sunk, sometimes in very deep water. The mullet rises to the "fly," as the trout does, and the larger river-fish are sometimes shot. A common practice of the rustics is to dam a favourite portion of a stream, and throw into it pounded pepper or other leaves. The fish are stupefied and are easily taken.

Fish is generally sold at *6d.* per lb., taking a high proportion to beef, which brings *8d.* The smaller fish sell at *3d.*

Castries, the capital of the island, has a population of about 5000; and about two dozen canoes, manned by two or three hands each, supply its daily wants. The poorer people consume a good deal of the smaller and cheaper kinds of fish, and are very fond of the common shark.

Flying fish seems to be plentiful, and if deep sailing boats were used as at Barbados, it is likely that the supply would be considerable and steady all the year round. Flying fish pickles well, like herrings; but Barbadians say that the effect of eating them pickled is that the human skin becomes spotted and stained. Hence pickled flying fish is avoided.

Near Margarita and the Testigos Islands, to the westward of Trinidad, immense quantities of fish are caught and corned, and occasionally a cargo of it reaches these islands.

But at present there is no export trade in fish from St. Lucia, nor is fish so abundant in its neighbourhood as to be ever likely to become an article of export. There are no banks swarming with fish, hence nothing can ever compete with the Newfoundland cod.

"Caveecht" fish is a fine relish and stand-by (like pepper-pot) when well prepared. This can best be done by frying the solid and dry kinds of fish, then treating them with vinegar, olive oil, pepper and spices. Suitably packed in jars, Caveecht fish lasts a long time, and is welcomed in England.

There are no benefit societies among the St. Lucia fishermen, and the trade receives no special protection nor any pecuniary aid from the Government.

R. P. CROPPER.

(No Exhibits from Saint Lucia have been received at the Fisheries Exhibition.)

STRAITS SETTLEMENTS.

THE Colony under the above designation lies, roughly speaking, between 1° and 6° N. Latitude, and 100° and 104° E. Longtitude. It consists of the islands of Singapore and Penang, and of three strips of territory on the mainland of the Malay Peninsula called Malacca (one of the three Settlements), Province Wellesley, and the Dindings. The seat of Government is the town of Singapore, and the form of administration is that found in Crown Colonies.

The population of the Straits Settlements, according to the census of 1881, amounted to 423,384, and was distributed as follows:—

	Europeans.	Malays.	Chinese.	Natives of India.
Singapore	2,769	22,155	86,766	12,058
Penang	612	21,772	45,135	15,730
Malacca	40	67,513	19,741	1,891
Prov. Wellesley ..	76	58,723	21,637	10,616
The Dindings ..	2	1,847	466	37

Fish forms, with rice, the principal article of food among all the native races. This is especially the case as regards the Malays, while the Chinaman, if he can afford it, will supplement his meal of rice and fish with a small quantity of pork. To supply the various markets about 15,000 persons are wholly employed in fishing operations, and in addition numerous families meet their own requirements, which can be readily done, as the waters of the colony literally teem with fish.

A considerable trade in salted fish is carried on in these Settlements. In 1882 Singapore received this commodity to the value of £317,000, and it exported the same article to the value of £320,000. The imports chiefly came from Siam (value last year, £140,000), French Cochin-China, East Coast of the Malay Peninsula, and Hong Kong. The exports principally went to Netherlands India (value last year, £220,000), British Burmah, China, and Hong Kong. Burmah and the neighbouring states also took dried fish from Penang to the estimated value of £40,000.

Fish-maws and sharks'-fins might in addition be included in this trade. The former are exported to the United Kingdom,—£3000 worth being forwarded there in 1882—Netherlands India, Australia, and China, and they are imported from Hong Kong, Netherlands India, Cochin-China, and even from Arabia. In the Straits Settlements fish-maws are obtained almost entirely from three kinds of fish, locally known as Siakap, Kuran, and Timereh. Of sharks'-fins about as much is imported as exported, the above-mentioned countries being those which are principally interested in the trade. Last year the imports at Singapore were valued at £6500, and the exports at £7600. From Penang the exports were valued at £8200.

The fishing class are, as a rule, well-to-do. The only taxes to which they are annually liable are as follows: for a license for a fishing boat, 25 cents; for a license for an inshore fishing stake, 5 dollars; for a license for an outshore fishing stake, 10 dollars.

There is no regular season for fishing, but during the North-east Monsoon (November to March) the markets are less supplied, and prices rule high. The great bulk of the fish brought to the various ports is caught in drag-nets, and at stationary fishing stakes.

It is estimated that about 20,000 tons of fish are annually disposed of in the town markets of Singapore, of which the value may be placed at about £470,000; while at Penang it is calculated that the daily consumption in the markets of that settlement is about 18 tons, of the estimated value of about £450. The retail price varies from one cent to nine cents a catty (1⅓ lb.).

The exhibits in this Court show about 150 different kinds of fish ordinarily caught in the Straits, and include a few specimens of freshwater fish found in the rivers of the Malay States. There are also exhibited models of the many implements and appliances employed in the capture of fish, and several articles actually used in fishing. The collection also contains models of fishermen's huts, and of the boats employed in fishing. There are, too, many samples of the kind of nets used in the various classes of fishing.

A few specimens of corals, crustacea and shells have been added.

The Government of the Straits Settlements is much indebted to His Highness the Maharajah of Johore, and to the rulers of the Native States of Kedah, Perak, Selangor, and Sungei Ujong for the many interesting exhibits which bear their name. They readily accepted the invitation of the Governor (Sir F. A. Weld, K.C.M.G.) to make the collection as complete as was possible in the limited time at disposal, and in this work the British Residents in the Protected Native States of Perak, Selangor and Sungei Ujong materially assisted.

CECIL C. SMITH.

TASMANIA.

THE following introductory remarks are taken from the special catalogue of the Tasmanian Exhibits :—

"It was not at first intended that this catalogue should be anything more than a bare list of the exhibits in the Tasmanian Court, entrusted to my care, but from the letters and communications received from the accomplished Secretary to the Commission, Philipp S. Seager, Esq., who has so carefully prepared the lists forwarded with the exhibits, I have gleaned such information as is made use of in the form of remarks on those forms which appear to me to be of special interest, deeming that this may not be unacceptable generally.

"The fact of several species of Salmonidæ having been so successfully introduced and established in Tasmanian waters is no less gratifying to pisciculturists here in England than it must be to the colonists themselves, who now enjoy good old English sport in fly-fishing. The future value of these introductions and additions to the fish food of Tasmania and her sister colonies cannot be too highly valued.

"Experts are of opinion that many of the specimens now exhibited are crosses between *Salmo fario* and *S. trutta* —some appear to have a strain of *Salmo salar*, others are undoubtedly *S. trutta*, and one or two may be said to be genuine specimens of *S. fario*.

"At the Great International Exhibition of 1879–80, held in Sydney, the Tasmanian Commission exhibited several very large specimens of *Salmo salar* weighing over 20 lbs.; and during the Melbourne Exhibition of 1880–1, salmonoids of from 2 lbs. to 4 lbs. each were retailed by the fishmongers in Melbourne at 10*s*. and 21*s*. apiece.

"While we cannot but admire the talent and energy expended on the intricate and expensive machinery now employed in the American and English fish-hatcheries, it is pleasing to observe the primitive methods and simple contrivances by which the *Salmonidæ* were at first and so successfully introduced to Tasmania. The same success has attended the introduction of the carp, tench, and river perch. Recently I have heard of a very laudable proposal (were it only needed) to introduce the herring into Australian seas, but surely our southern friends are aware that numerous shoals of the very finest herrings (*Clupea* sp.) in the world annually pass along our coasts, sometimes entering the mouths and estuaries of our rivers and bays: and in addition Tasmania can boast of her sprats and anchovies, which occur also on the southern shores of the mainland in such large shoals that they only require to be properly fished to become a source of wealth to the colonies. The Tasmanian grey mullets (*Mugilidæ*) are another family capable of affording, when cured, an important article of food either for home consumption or export.

"Among the fishes will be found some remarkable forms, extremely interesting in a scientific point of view. The collection also contains all the principal food fishes, such as the baracoota, *Thyrsites atun*, and the king-fish, *Thyrsites solandri*. Several species allied to the trumpeter (*Latris hecateia*, *Latris Forsteri*, &c.), *Chilodactylus Al-*

porti, &c., and others. Samples of the "black fish" and "bream," the cyttus, "boar fish," "trevally," perch, sprats, herrings, anchovies, and grey mullet, forming a well-chosen and representative collection of the Tasmanian fish fauna.

"Photographs and coloured paintings of the most important have been added, also photographs of the City of Hobart and the environs thereof, and forest and native scenery, with a very interesting series representing the Derwent River and its salmon ponds, &c.

"Lieutenant Bedome has contributed a very complete collection of the mollusca of Tasmania, and among the fish-destroying mammals may be seen a fine specimen of the seal or sea-leopard, *Stenorhynchus leptonyx*, Grey.

"Among the fish-eating birds are specimens of the "*Mutton Bird*," *Puffinus brevicaudus*, which is still found in immense numbers on some of the islands in Bass's Straits, and supplies a large quantity of oil annually.

"Among the crustacea are some large and interesting species of edible crayfish, both from the sea and fresh water, one species of which (*Palinurus Edwardsii*) already forms an article of export to New South Wales. This species attains a length from one foot to eighteen inches, and finds a ready sale at from 1*s*. 6*d*. to 2*s*. 6*d*. each. The Tasmanian freshwater species (*Astacopsis Franklinii*) exceeds that of its representative on the mainland, but unfortunately has not found its way into the general market."

Tasmania exhibits a fine collection of shells, and specimens in alcohol of the principal food fishes. Models of their fishing boats, nets, and fish-destroying birds, with seals and other animals peculiar to the country;

also photographs and coloured paintings of fishes peculiar to the coast.*

The following particulars relative to the salmon fishing in this colony have been collated from the Reports of the Tasmanian Salmon Commissioners for the years 1879 and 1880.

The *Salmonidæ*, both migratory and non-migratory, continue to multiply so rapidly that, if their increase be not checked by the occurrence of some such epidemic as that which has recently proved so fatal in certain British rivers, the streams in Tasmania must, in the course of a very few years, be thoroughly stocked.

Most of the streams on the north, south, and east coasts are already fairly stocked with the *Salmo fario*, and others contain the *Salmo trutta;* but at present, the Derwent and its tributaries are the only rivers in Tasmania in which the true salmon is believed to be present. The Commissioners will endeavour to remedy this partial distribution of the *Salmo salar* at the earliest opportunity.

For the last four years the Commissioners have had collected from the spawning beds in the Plenty certain large ova, of a pink colour, much resembling those of the *Salmo salar* originally received from England, some of which have been sent to the different Colonies, and some have been placed in several of our own rivers. We think it more than probable that these ova will prove to be of the *Salmo salar;* but, if any should prove to be *Salmo trutta*, it is satisfactory to know that, in general estimation, these rank as little, if at all, inferior to the former.

In October, 1879, as has been the case about that period for the last five years, smolts, dressed in their beautiful bright migratory scales, came down the water-race which supplies the ponds, evidently making their way to the sea.

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* Catalogues of the Shells may be obtained in the Court.

Their numbers, however, on the last occasion were far greater than in any previous year,—in fact they came down in millions; and the rush continued for at least a fortnight. Many of them, notwithstanding the efforts of the Assistant to guide them into the Plenty, found their way into the ponds; but their restlessness and anxiety to get to sea were such that they always immediately escaped when an opportunity was afforded them. The trout, on the contrary, which happened to be present, never showed any anxiety to leave the ponds.

In October, 1880, as in former years, smolts again made their appearance in the River Plenty on their way to sea; but in consequence of the diversion of the river by flood, the numbers which entered the shoots leading to the ponds were less than on former occasions. The Commissioners have caused some of these fish to be retained in a special pond, in the hope that they will deposit ova, and thus enable their progeny to be placed in other rivers of the Colony. Should the experiment prove successful there will be no difficulty in rapidly stocking other rivers with migratory salmonoids.

It has been observed when captured migratory species are introduced into our breeding ponds and permanently retained there, that at first, during the migratory season, they make considerable effort to escape from their confinement. It has also been noticed that although they continue to present a healthy outward appearance, yet if the forced imprisonment is prolonged the generative organs are seriously affected, for they invariably become perfectly sterile. These observations may be of much interest to ichthyologists and to others interested in the natural history of introduced fishes.

Several captures of salmon of from 4 to 7 lbs. in weight have been made by fishermen with nets; and a fine specimen, upwards of 7 lbs., was taken in Storm Bay, at a locality about twenty miles seaward of the mouth of the parent river, the Derwent. Fish (*Salmonidæ*), as to the exact variety of which various opinions have been entertained, of fully 20 lbs., have been caught with rod and line. In addition to these, a fine specimen of *Salmo fario*, of 28 lbs. was found dead in the Huon River.

The Commissioners still consider it unadvisable to recommend any alteration in the existing restrictions as to netting in the Derwent, not only for the protection of the *Salmonidæ* but also in the interest of the indigenous fish which come into the bays and shallows above Hobart Town to deposit their ova,—these undisturbed retreats serving afterwards as a protection for the young fish until they are able to push out into deep water, and protect themselves. It is satisfactory to remark that since the prohibition of seine fishing the supply of fish for the market has been both more abundant and more regular than for many years previously,—an unanswerable argument against throwing open the protected portion of the Derwent.

During the year 1880, 23,000 ova were supplied to the other Colonies, and 2350 fry were distributed in various rivers of this colony. The Commissioners are always prepared to supply the requirements of any locality upon application being made to them.

The revenue derived from sale of ova during season 1880 and for fishing licences during season 1880–1 (ended 1st May), was more than sufficient to cover the cost of the establishment. The expenditure was £292 9*s.* 6*d.*; the revenue by sale of ova, £105; by fishing licenses, £191;

Total £296. Poachers are still very numerous; but the number of licensed rod fishermen having increased from 138 in season 1876–7 to 382 in the season just closed, is a satisfactory proof that the offenders are not now so numerous as formerly.

E. P. RAMSAY.

AMERICA, UNITED STATES OF.

THE FISHERIES OF THE UNITED STATES.

IN 1880, according to the returns of the Census Bureau, the numbers of persons employed in the fishery industries of the United States was 131,426, of whom 101,684 were fishermen, and the remainder shoremen. The fishing fleet consisted of 6605 vessels (with a tonnage of 208,297·82) and 44,804 boats, and the total amount of capital invested was $37,955,349, distributed as follows:—vessels, $9,357,282; boats, $2,465,393; minor apparatus and outfits, $8,145,261; other capital, including shore property, $17,987,413.

The value of the fisheries of the sea, the great rivers and the great lakes, was placed at $43,046,053, and that of those in minor inland waters, at $1,500,000—in all $44,546,053. These values were estimated upon the basis of the prices of the products received by the producers, and if average wholesale prices had been considered the value would have been much greater. In 1882 the yield of the fisheries was much greater than in 1880, and prices both "at first hand" and at wholesale were higher, so that a fair estimate at wholesale market rates would place their value at the present time rather above than below the sum of $100,000,000.

Since 1865, the fisheries have increased in extent and value to a degree without parallel in their previous history. Before the war of the rebellion (1861–1865) many of the fisheries which are now most important had no existence, and for four or five decades preceding only the oyster fishery, whale fishery, cod fisheries, mackerel fishery, and shad and alewife fisheries were of any considerable importance. The recent increase is chiefly due (1) to the introduction of the improved methods of refrigeration, by means of which sea-fish are distributed widely throughout the interior of the country; (2) to greatly extended facilities for steam transportation; (3) to the extended introduction of methods of packing in hermetically-sealed cans, and of more attractive methods of preparing for market the several kinds of dried and smoked fish; (4) to the introduction of improved vessels and apparatus by means of which the expense of capture has been greatly diminished; and (5) to the efforts of a considerable number of enthusiasts, anglers, statesmen and philanthropists, who by the organisation of Fishery Societies, State Fish Commissions, and the United States Fish Commission, and by their publications, have awakened public interest, secured extensive appropriations of public money for the propagation and acclimatisation of useful fishes, and have demonstrated the value to the country of many previously neglected fishery resources.

The fisheries of the New England States are the most important. They engage 37,043 men, 2066 vessels, 14,787 boats, and yield products to the value of $14,270,393. In this district the principal fishing ports in order of importance are: Gloucester, Portland, Boston, Provincetown and New Bedford, the latter being the centre of the whale fishery. New England was settled in 1620 by colonists chiefly from the western counties of England, who selected that portion of the coast on account of its peculiar fitness for the prosecution of the fisheries, and by the middle of the seventeenth century there was a considerable fleet of ketches and snows engaged in the cod fishery on the off-shore banks, where, especially on the banks of Newfoundland, France, Spain, Portugal, and England, already had a fleet of several hundred large vessels. Just before the war of the revolution New England had 665 vessels and 4405 men employed in its fisheries.

Next to New England in importance are the South Atlantic States, employing 52,418 men, 3014 vessels (the majority of which are small, and engaged in the shore and bay fisheries), 13,331 boats, and returning products to the value of $9,602,737.

Next are the Middle States, employing in the coast fisheries 14,981 men, 1210 vessels, 8293 boats, with products to the amount of $8,676,579.

Next are the Pacific States and Territories with 16,803 men, 56 vessels, 5547 boats, and products to the amount of $7,484,750. The fisheries of the Great Lakes employ 5050 men, 62 vessels, and 1,594 boats, with products to the amount of $1,784,050. The Gulf States employ 5131 men, 197 vessels, and 1252 boats, yielding products to the value of $545,584.

Forty-three distinct fisheries are recognised by American writers, each being carried on in a special locality, and with methods peculiar to itself. Among the most important of these are the oyster fishery, the off-shore cod fishery, the whale fishery, the fur-seal fishery, the mackerel fishery, the menhaden fishery, the halibut fishery, the Antarctic seal and sea-elephant fishery, the west-coast salmon fishery, the lobster, the shad and alewife fishery, the swordfish fishery, and the clam fisheries.

The off-shore fisheries are carried on chiefly by citizens of the New England and Middle States, and are prosecuted on the great oceanic banks extending from Nantucket to

Labrador, and upon the ledges and shoals between these and the coast.

The great purse-seine fisheries for mackerel and menhaden are carried on north of Cape Hatteras at distances from the shore varying from one mile to one hundred and fifty miles. The fishing grounds in the Gulf of St. Lawrence, formerly frequented by many hundreds of American vessels, have been entirely abandoned since the introduction of the purse-seine, and in 1882 only one vessel visited those waters, returning with about 200 barrels of mackerel. The oyster fishery is located for the most part between Cape Hatteras and Cape Cod, chiefly in the great inland bays. In all the great rivers of the Atlantic coast are fisheries for the anadromous shad and the two species of alewife. About the Keys of southern Florida is an extensive sponge fishery, and on the shoals of the Gulf of Mexico the red snapper and grouper fisheries are yearly increasing in value. The fur-seal fishery is chiefly located upon the Pribylov Islands of Alaska. A small fleet of vessels yearly penetrates to the icebound islands of the Antarctic for seal-skins and sea-elephant oil. The whaling fleet, with head-quarters at New Bedford and San Francisco, in the main frequent the North Pacific, though a number of smaller vessels, many of them from Provincetown, pursue the sperm whale in tropical waters. The salmon fishery is seated chiefly upon the Columbia River and its tributaries, though other rivers in Oregon and California produce large quantities of salmon, which is extensively "canned" and exported. The most valuable product of the Great Lake fisheries is the whitefish. The swordfish fishery of southern New England, though employing but 40 vessels, and perhaps 160 men, produces 1,500,000 pounds' weight annually.

The export of American fishery products is comparatively small, owing to the fact that the demand for such products for home consumption is really greater than the supply, and is constantly on the increase. In 1880 the total value of exported fish products amounted to $5,744,580; of which, according to custom-house records, England received $2,601,017. Of the quantity sent to England $1,596,007 was in canned preparations, and $363,790 in fresh oysters, the remainder being chiefly products of the whale fishery. In former years there was an extensive export trade in dried cod with Spain and Portugal, but this is now entirely abandoned. Large quantities of canned salmon are sent to China, Japan, and Australia.

At present no subsidies are allowed to fishermen, except that the duties on imported salt, used in the preparation of fish, are remitted; this practice was begun in 1863, at which time the old bounty law was repealed.

The United States, with the intention of aiding its fishermen, has paid to Great Britain the sum of $5,500,000 for the privilege of fishing in the British Provincial Waters from 1873 to 1885.

Since 1871 the United States has appropriated over one million dollars to be used by the United States Fish Commission in behalf of the fishermen and fish consumers, and under the direction of the Commissioner, Prof. Spencer F. Baird, very important results have been accomplished. All the State governments, with the exception of six, have established State Fish Commissions, and most of them have been liberally supported by grants of money.

The undeveloped fishery resources are very great. Many of the fishes and invertebrates which in Europe are highly valued by the poorer classes are never used here. Only about 150 of the 1500 species of fishes known to inhabit the waters of the United States are ordinarily found in the markets.

An elaborate report upon the fishes and fisheries of the country in 1880 is now being published by the Government—the joint production of the Fish Commission and the Tenth Census.

G. BROWNE GOODE.

Assistant Director of the U. S. National Museum,
Washington, and Commissioner to the Exhibition.

[NOTE.—The participation of the United States in the Exhibition is in accordance with an Act of Congress approved July 18, 1882, by the terms of which the United States Commissioner of Fisheries was instructed to prepare, under the auspices of the Department of State, a complete and systematic representative exhibition of the fisheries of the United States.]

BELGIUM.

THE most important fishery of Belgium is the maritime fishery, which is extensively carried on along the shores of the North Sea and in Western Flanders, especially at Ostend. Since 1830 the fishing industry has greatly developed.

Thus the harbours of Ostend, Blankenberghe, Heyst, Panne, and Nieuport, which numbered 175 boats in 1836, had 318 in 1880. Ostend alone, the most important fishing port, possessed in 1836 82 fishing-boats, 185 in 1880, 206 in 1881, and 178 in 1882.

Since 1830 the Government has exerted itself by every means to encourage and develope the fishing industry upon the Belgian coasts. Those engaged in it enjoyed an exemption from an entire series of dues, and government grants in aid of the fishery were allowed annually until the year 1866. These grants in no way assisted the development of the fisheries ; in fact, their importance diminished year by year. In 1864 those interested in maritime fishing showed their anxiety for its future. The Government thereupon appointed a commission (20th April, 1865) for the purpose of inquiring into the condition of this fishery, and to take proper measures for its preservation. The report of the commission presented to the Chamber of Representatives on the 17th May, 1866, recommended the entire abolition of the grants to the various fisheries; it applied for the foundation of a school for seamen on board a vessel that should exercise at sea the supervision of the fishery: and it also recommended the free entry of fish from all nationalities. Besides this the commission considered that for the re-establishment of its fisheries the country must rely upon private enterprise, a good organization of the fishery fleet, and a fair rate of wages for the fishermen. The Government has endeavoured to carry out the recommendations of the commission.

The grants were definitely suppressed in 1867. The Government chartered at the same time a large vessel for the supervision of the fishery. They instituted likewise a school for seamen destined for the crew of the fleet. Each year, this ship, at the commencement of June, cruises for four months in the North Sea in the midst of our fishing-boats. Its mission is to prevent the fishermen from neglecting their duty by smuggling upon the coast of England, to give them help and advice, and to furnish them with medical aid in cases of accident, &c.

Notwithstanding the foundation of the school for seamen, which numbers at present sixty young men, on account of the increase of the number of fishermen's boats, complaints are made of the difficulty of procuring the requisite crews. This arises from the fact that most of the lads trained on the guardship enter the mercantile marine, the mail service, or work in light ships, &c., as soon as the guardship, on its return from the summer cruise, winters in the port of Ostend. The school for seamen trains therefore good sailors but few fishermen—hence the scarcity. To remedy this state of affairs, it is proposed that the Government should cause a large cutter to be constructed, manned with seamen from the guardship, who, in winter, would devote themselves to net fishing. These young men would thus learn net-fishing as in summer they learnt fishing with hooks. They would then be more surely retained for the principal industry of our coasts. The cutter in question would in addition be provided with all practical improvements, such as a steam winch for raising the net. It could, besides, visit the principal ports and fish depôts of England for general information.

At the same time that the Government abolished the premiums and established the training ship for seamen, it suppressed all restrictive regulations of fishing, such as the law respecting the size of the mesh of the nets according to the time of year, to prevent the destruction of fry.

Those competent to judge expressed an opinion that these measures, besides being vexatious to fishermen, did not benefit the fishing industry, and that, no matter what might be the mode of fishing employed, there was no reason to fear a scarcity of fish in the North Sea. The result, both in this country and in Holland, since the free system was introduced, proves that that opinion was well founded.

In 1870 a law abolished the inland duties established on salt, and sea water; article 2 declares the suppression of the dues on all fish importations.

Our sea fishery, freed from all restriction, has not been slow in developing.

As stated in the first part of this report, the number of smacks has considerably increased, and their construction has also improved. Our shipowners, in imitation of the English, have adopted boats that for shape and rigging will bear comparison with any. Built for rapid sailing, which is necessary for abundant harvests of fish, they are still unsatisfactory, but that is the fault of the fishermen, who cannot handle them so dexterously as their English neighbours.

It is an incontestable fact that, although since 1830 prices have at least doubled, the sale of sea fish has grown enormously. Fish always abounds in the market of Ostend, and the supply increases every year. Since 1875 the municipality of Ostend has taken over the management of the fish market. The following is a table of the annual proceeds of the sale of fish at this market since its acquisition by the corporation :—

Produce.	1875.	1876.	1877.	1878.
English . .	333,812·50	457,142·30	424,788·05	539,867·20
French . .	471,655·10	568,360·00	344,105·80	623,608·70
Dutch . .	9,682·20	8,543·60	8,376·20	,,
Other Nations	1,565·00	14,945·00	10,037·00	28,540·00
Belgian . . (Ostend)	1,490,956·85	1,577,984·65	1,800,394·85	1,884,752·30
Total frs. .	2,307,671·65	2,626,975·55	2,587,701·90	3,076,768·20

Produce.	1879.	1880.	1881.	1882.
English . .	641,242·55	442,445·89	363,355·00	586,325·50
French . .	437,543·20	544,936·15	605,447·40	615,219·10
Dutch . .	,,	,,	2,090·50	1,610·40
Other Nations	76,102·50	2,248·30	592·94	58,359·00
Belgian . . (Ostend)	1,842,934·20	2,520,089·05	1,953,256·20	2,207,073·60
Total frs. .	2,997,822·45	3,489,719·39	—	3,468,587·60
Cod liver oil .	—	—	268·50	—
Total . .	—	—	2,925,010·54	—

The following is the produce of the two first months of 1883:

	Belgian.	English.	French.	Sundries. (small fish).
January....	271,193·05	44,259·50	58,312·50	11,607·00
February...	239,956·60	39,674·00	40,056·70	9,626·00
Total...	511,149·65	83,933·50	98,369·20	21,233·00

This considerable development of national fishery does not appear to have suffered by the importation of fish in vessels other than fishing vessels, nor by what is brought by rail. And yet these importations have greatly increased, steamers arriving at Antwerp constantly, half-laden with fish, from Hull and Grimsby. Besides this, a great deal comes by rail from Holland. The following is a statement of the foreign trade during the last two years:—

Importation and Exportation.	Herrings.		Other fish.	
	1881.	1882.	1881.	1882.
Importations, kilog.	7,553,597	8,536,998	8,571,000	7,870,816
Exportations „	70,765	270,005	996,641	1,159,836

Our shipowners are, at the same time, contractors. They supply sails, ropes, ferry boats, barrels, &c.—in fact, everything. They have cooper's sheds, sail-lofts, &c. Our fishermen complain that they are not so well paid as the English fishermen, notwithstanding the enormous profits realised by the shipowners. The fishermen receive only 6 per cent. on the proceeds of the sale. Furthermore 1 per cent. of this allowance is kept back, for the purpose of making good losses resulting from the loss of fishing-tackle, ropes, &c., which loss is charged to the fishermen and owners, and when, at the end of the season, the accounts are balanced, the share to be paid by the fishermen is deducted, either from their salary or from their share of the proceeds of the fishery.

For a long time there has existed a Fishermen's Aid Society, an association for mutual assistance, which provides help for members when they can no longer go to sea. In order to implant a taste for fishing among the children of the population of the sea coast, and to give them at an early age some knowledge of it, an elementary acquaintance with the subject is imparted in some of the normal schools. Monsieur Ch. De Smet of Ostend is one of the promoters of the idea of giving instruction in fishery matters in these schools. He has also had exhibited life-sized diagrams of the principal fish of our coasts. His collection, which was shown at the National Exhibition of 1880, is now at the *École Communale*, at Ostend.

Besides the maritime fishing, we have in Belgium river fishing, which, though less important, is still of great value on the ground of public revenue and as a food product.

The mountainous parts of our provinces are in a great measure restricted to river and stream fish, on an average dearer, less nutritious, and more irregular in the supply than sea fish.

Considering the numerous and various advantages which the fresh-water fisheries present, and in view of the impoverishment of our streams, the Government had for a long time been urged to reform the legislation concerning fishing, which was governed by laws dating as far back as 1669 and 1804. A new law was instituted on the 15th February, 1883. Good results are expected from this law, and the measures which will be taken to enforce its observance.

The following are some figures relating to the distance in kilomètres of the right of fishing in rivers, streams, canals, or parts of them, let out by contract.

Rivers and Streams:—Basin of the Escaut, 514,517 kilos; Basin of the Meuse, 540,238 kilos; Basin of the Yser, 45,534 kilos; total, 1,100,289 kilos. *Canals.*—Basin of the Escaut, 417,898 kilos; Basin of the Meuse, 65,841 kilos; Basin of the Yser, 39,819 kilos; other canals, 175,668 kilos: total, 699,226 kilos. Grand total, 1,799,515 kilos.

The inspection and preservation of fishing in streams through public lands is vested in the Belgian Department of Woods and Forests (*L'Administration Forestière*).

In the public canals and rivers, the fishing is let by tender, as in other state provinces, or by licence when no other offers are made. There are fixed scales which form the basis of these two ways of letting.

The fishery rents amounted to—In 1861, 40,180·58; 1865, 43,369·71; 1870, 40,088·97; 1875, 52,365·21.

To assist in restocking our streams, the Government, on the 21st January, 1883, issued a royal decree, by which fishing is prohibited for the space of one year in those parts of streams not navigable, that run through domains subject to the Department.

In 1861, certain parties interested in such matters founded the "Belgian Society of Pisciculture." Its object was to create one or more ichthyological establishments, to propagate, according to the best method, all fish, crustaceans and molluscs, of this and other countries, which are considered the most useful for consumption. This society was subsidised by Government until 1866, when the stoppage of State grants caused the society to be wound up. It had never been a great success, nor produced any important results. Its failure, however, need not make us despair for the future, as the question of artificial fish-rearing is still comparatively an open one.

CHILI.

FISHERIES.

THE very extensive coast of Chili abounds with fish of infinite variety. Her lakes and rivers are also well stocked with trout and *pejereyes*, the latter very delicious and peculiar to Chili. Along a great extent of the coast the sea is usually very calm, and therefore fishing is carried on with little difficulty. The boats used for the purpose are generally simply constructed and not remarkable for any peculiar shape. Formerly, a sort of twin-boat called a "balsa" was very much in use. It was made of seal skins, inflated with air introduced through a leather or india-rubber tube, and was very well adapted for shores where the sea breaks roughly, as it was by construction unsinkable. These boats have long ago, however, been superseded by wooden ones, much the same as those used in England. The "balsas" are still to be seen in different places along the coast, chiefly in the north.

It would be difficult to enumerate the immense variety of excellent fish which are caught off the coast of Chili. The kinds most preferred are corbina (a species of white salmon), lenguado (flat fish), pescada (Chilian haddock), jerguilla (rock fish), and pichihuen.

The sea around the island of Juan Fernandez is still richer in fish, the amount being prodigious. Some of the varieties of crabs and lobsters to be found there attain an immense size.

The Chilian fisheries not only produce a plentiful supply of fresh fish for the home consumption, but there is also a large trade done in dried fish, which is in great demand for the numerous trading vessels which constantly arrive at the different ports of the Republic. The shell and other fish, preserved in tins, are pronounced by many to be unequalled, and the price being exceedingly moderate, there is no doubt but that they will shortly be largely exported to Europe. Bacalao (rock cod) have been caught at 75 fathoms depth off the island of Juan Fernandez, weighing 100 lbs.

FISH CULTURE.

In Chili there is no establishment of a special character for freshwater pisciculture. Doctor Charles Segeth, a German medical practitioner, importer of two varieties of the Cyprinis Auratus, which has become very extensively propagated, and of the Cyprianus Carpio, keeps the latter fish in a common pond ever since it was imported into Chili, some years ago, and there it grows and breeds, giving hope of their being soon in numbers sufficient to sell for its propagation all over the country. It does not appear that in the maintenance of this pond its owner has used any apparatus for the bringing up of the fish. The same gentleman will soon import the European astacus fluviatelis. There are salmon ova just arrived in the country, for the second time, for putting into the rivers in the southern part of the country, which are very well suited for this class of fish.

The commissioners in Chili for freshwater fish, being under the impression that the London Great International Fisheries Exhibition was one rather of the industrial products of fisheries than collections for the advancement of scientific knowledge, have only collected and forwarded specimens of freshwater produce, which on account of their abundance and quality are articles of commerce for the food of the inhabitants to be had in all markets.

PARTICULARS OF THE CHILIAN WHALE FISHERIES.

Two or three Chilian companies own fleets of whaling vessels. The general cruising grounds of these are in the Pacific Ocean, from the Bay of Panama, latitude 8° north, to Chiloe, latitude 47° south, and from the west coast to longitude 120° west.

There are also several whaling stations or shore parties at different points on the south coast of Chili.

The sperm oil obtained is usually shipped to England for a market, but the other oils are mostly consumed in the country, principally in the mines or in different manufactories.

LAWS RELATING TO FISHERIES.

The Chilian civil code contains, amongst others, the following regulations :—

Art. 611. Fishing in the sea is free to all, but forbidden in the coast waters (*mar territorial) to others than Chilian citizens or domiciled foreigners.

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* (Mar territorial.) These words are thus explained in Article 593 of the Civil Code—"The sea for the distance of one league (legua marina) from the shore, measured from low-water mark, is 'mar territorial,' and forms part of the national dominions, but police supervision extends, in what concerns the security of the country and the observance of the fiscal laws, to a distance of four leagues, measured in the same manner."

In public rivers and lakes fishing is unrestricted.

Art. 612. Fishermen are allowed to make the necessary use of the beach in the exercise of their craft. They may build huts thereon, stretch and dry their nets, draw their boats and implements ashore, land the produce of their fisheries, &c., but they may not make use of any structure or building on said beach belonging to other parties without the previous permission of the owners thereof, neither may they prevent other fishermen from freely using the beach.

Art. 613. It is likewise permissible for the purposes above mentioned, to make use of the land contiguous to the beach for a distance of eight metres inland; but not of the buildings or structures thereon. It is also forbidden to cross over fences, or to trespass in any plantation, orchard, field, or enclosure there may be there.

Art. 614. The owners of the land contiguous to the beach may, if they please, cultivate said lands, raise fences, buildings, or structures within the aforesaid eight metres, provided they leave adequate and convenient spaces at intervals for the use of the fishermen. If this regulation be not complied with, fishermen can apply to the local authorities for the necessary remedy.

Art. 615. It is unlawful for persons who may fish in lakes or rivers to make use of the buildings or structures on shore, or to trespass on the cultivated lands. They are also forbidden to cross fences.

* * * * *

Art. 622. Fishing and the chase are in other respects subject to the special regulations that may be issued to meet the circumstances of the case.

It is, therefore, not permissible to shoot or to fish except in places, and seasons, and with the arms or means that may not be forbidden.

SEAL FISHERIES.

In consequence of the great development of the seal fisheries in and about the Straits of Magellan the Chilian Government has lately appointed a Commission to study the question and draw up a report thereon, in order to introduce a law to enforce a close time, and to extend to the waters of those regions the regulation mentioned above in Art. 611 of the Civil Code.

WHALE FISHERIES.

The following article is contained in the Custom House Regulations of Chili:—

Art 14. Whaling ships touching at any of the Ports of the Republic for the purpose of taking in stores or for repairs, are not obliged to present a manifest of the ship's goods, but, should they land any article of commerce, they shall be subject to the same regulations as other ships.

MARCIAL MARTINEZ.

Envoy Extraordinary and Minister Plenipotentiary
from Chili to the Court of St. James's.

CHINA.

THE following particulars are taken from the official Yellow Book—No. 11, Miscellaneous Series, Imperial Maritime Customs, China—which contains the special catalogue of the Chinese collection. The Chinese Government placed the matter in the hands of Sir Robert Hart, K.C.M.G., Inspector-General of Customs; and under his directions, an exhibit intended to illustrate the Swatow Fisheries, supplemented by some interesting objects from Ichang, Ningpo, and Takow, has been provided.

Swatow is situated at the north-eastern corner of the province of Kwangtung in latitude 23° 20′ 43″ N. and longitude 116° 39′ 3″ E., near the frontier of Fukien. The river Han flows past the city, and joins the sea, after many ramifications, a few miles below the town.

In the district of Swatow, T'at'oupu and Haimēn on the mainland, and the Island of Namoa facing a mouth of the river, are the most noteworthy stations for deep-sea fishing. Large fleets belonging to these places are daily engaged in exploring the waters.

No restrictions are laid on the fishing grounds on the part of the Government, and fishing is carried on all the year round. All boats must be registered at the port to which they belong, and various fees, depending on the size of the boats, are collected by the authorities from the fishermen ere they are allowed to put to sea. The licences issued generally hold good for five years. At each of the above-mentioned places the division of the boats and the distribution of the profits are different. The crews are always interested in the out-turn of the sales. There are no benefit societies of any kind where the fishermen might ensure their lives to provide for cases of accident, nor are there assurance societies where the boats and gear might be insured against the dangers and risks of the sea.

The number of fishermen of the Swatow district is estimated at 12,500, but it is probable that this figure is far below the actual number.

The fish trade of Swatow is not very important as regards exports to Hongkong and native ports. Cuttlefish and dried fish alone have gained attention hitherto. The principal buyers of fish at the marts of T'at'oupu and Haimĕn are the inland districts.

For cuttlefish the season extends from March to September, but during the months of June, July, and August, the haul is generally most abundant.

The stake nets are largely used in this district, near Namoa particularly, where there are the largest fishing stakes in China.

For small fish the Chinese use silk nets, which are very strong and durable.

Digging for broken shells at the mouth of the river Han forms a considerable industry. There being no limestone found in the districts adjoining the sea-shore, shells are burnt into lime, and about 350 boats of a carrying capacity varying between two and three tons, are constantly engaged in this trade.

In the upper region of the river Han the fish are caught by strewing poisonous substances on the water; the river being so well stocked with fish no objection is raised by the authorities to this process. For the same reason pisciculture has not received much attention in this district, but the system of fishponds is worthy of notice.

Ichang is situated on the Yangtsze, nearly in the centre of China, at a distance of 1000 miles from the sea. The fishing divides itself into three kinds:—

1st. Fishing in the river itself.

2nd. Fishing in the numerous mountain streams which fall into the Yangtsze.

3rd. Fishing in the shallow lakes and large ponds which abound in close proximity to the town.

Fishing with a live otter is perhaps entirely peculiar to this immediate neighbourhood.

Ningpo.—The city of Ningpo stands on the river Yung, twelve miles from the sea, in latitude 29° 58″ N. and longitude 121° 22′ E., about 90 miles south of Shanghai. It is the point of convergence of an extensive river and canal system, and at the same time occupies a commanding position with reference to the well-known Chusan Archipelago. Partly owing to the wealth and enterprising character of its population, and partly to its favourable situation, Ningpo is one of the most celebrated places in China for the extent and variety of its fishing industries.

Takow, Formosa.—The objects catalogued under this heading were gathered from so many places besides Takow itself, viz., Anping, Lambay Island, the Pescadores Islands and the South Cape, that, while termed for brevity's sake the Takow collection, they may be regarded as representing the fisheries of South Formosa and the Formosa Channel.

The island of Formosa is politically a part of the Chinese province of Fukien, from which it is separated by the stormy Formosa Channel some 100 miles wide. It lies between the 22nd and 25th parallels of north latitude, and in east longitude between the 120th and 122nd meridians.

Takow was opened to foreign trade in 1863. It is thirty miles south of Taiwanfu, which was opened by the stipulations of the treaties of 1858. Anping is on the coast two miles west of Taiwanfu. The Pescadores Islands are a group of twenty-one islands in the Formosa Channel, about twenty-five miles west of Formosa. Lambay Island lies a short distance off the mainland, twelve miles south of Takow, and the South Cape is the extreme southerly point of Formosa.

DENMARK.

A.—DENMARK PROPER.

THE most important of the *fisheries in the open sea* are the following:—1. The fishery of haddock, cod, and flat fishes, carried on in the North Sea and the Skagerak at a distance of eighteen to twenty-two English miles from the coast of Jutland, by means of long lines.* The proceeds of this were estimated in 1879 at 1,378,000 crowns, but must be supposed to have increased since. 2. The hook-fishery of salmon in the Baltic, carried on from Bornholm and Christianso, of which the total proceeds were estimated in 1879 at 507,800 crowns. 3. The fishery of herrings by means of drifting-nets† in the Great Belt, the Kattegat, and in the Baltic from Bornholm. The value of the autumn fishery of herrings in the Kattegat and the Great Belt is estimated at 350,000 crowns. The most important *Coast fishery outside the Fjords* of the Baltic and the Kattegat, in the Belts and the Sound, has for its object the so-called "Blanke Aal," a variety of the common eel (*Anguilla migratoria*, Kr.). This fishery is carried on by means of Aalegaarde,* Slæbevaad,† Pulsvaad,‡ Snurrevaad,§ hooks, boxes, eel-spears, &c., and the annual proceeds are estimated at 1,600,000 crowns. Besides this a certain quantity of spring-herring, cod, and gar-fish are taken by means of Bundgarn.‖ The *Fishery in the Fjords* or narrow inlets from the sea, which are so numerous in Denmark, comprises, besides salt-water species, several fish properly belonging to fresh water, such as pike and perch, the water of the Fjords being in many places brackish. The value of this fishery upon the whole cannot be estimated with any accuracy. Special mention must be made of the Limfjord which separates the northernmost portion of Jutland from the main portion. Since 1826 when a channel was formed between the North Sea and the head of the Limfjord, the latter has become virtually a Sound, and the fishery has in part become a salt-water fishery. Eels are taken here by means of eel-spears of various constructions, nets, hooks, and weels; herrings by

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* The Danish term rendered "long line" is "Bakke." The implement consists in a long line to which shorter ones are attached at certain intervals; these latter (which are called "snoods" in English) being furnished with baited hooks and terminal floats. The term "trawl" generally means "trawl net"—a net dragged along the sea-bottom and kept down by weights, as used by the fishermen in the North Sea.

† "Drifting-nets" stands for "Drivegarn"—nets floating near the surface, or at any rate not fixed or kept down near the bottom.

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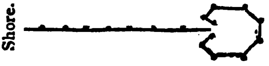
* "Aalegaard" means a set of weels.

† "Slæbevaad" is a net dragged along the bottom, but not so heavy as a trawl net.

‡ "Pulsvaad" is a net into which the fish is driven after the net has been conveniently fixed, by beating the surface of the water with a peculiar club-shaped wooden instrument, of which the broader end is excavated a little. The instrument is driven down against the water with the excavated end foremost. The noise produced can be heard at a great distance, and frightens the fish into the net.

§ "Snurrevaad" is a net of which one end is firmly fixed by means of an anchor, the boat being worked up to the latter.

‖ "Bundgarn" means a net forming an enclosure in the whole depth of water, fixed on rafters driven into the ground, and with an inverted opening towards a net stretched towards the shore intercepting fish and leading them to the enclosure.



means of Vaad [*] and Bundgarn; cod are caught in nets and with hooks; flat fish are taken in Vaad or Nedgarn; [†] lobsters too are fished for here. The value of this fishery was put down as amounting to 450,000 crowns in 1881. Besides this, two millions of oysters are taken annually, to a value of 300,000 crowns. The *Fresh-water Fishery* of Denmark is of no great importance on account of the small extent of lakes and rivers. The species of fish are those usually occurring in that latitude. The whole value may be taken to be about 150,000 crowns, of which about 60,000 crowns' worth are exported to Germany. The total annual value of the fisheries in Denmark proper may be estimated at about 5,500,000 crowns, of which 2,300,000 crowns represent the export to other countries, 2,000,000 crowns the value of the fish sold in Denmark, and 1,200,000 crowns the consumption of the fishing population itself. The number of families living principally by fishery is about 4300; 7000 families derive subsidiary income from fishing. In all, 11,300 families are connected with this industry. The number of boats employed having decks or wells is about 1000, besides from 4000 to 5000 open boats. The tonnage of these craft cannot be stated. The fish exported consists mainly of haddock, flat-fish, salmon, oysters, herrings and eels, the two last kinds either fresh or smoked. By far the greater portion goes to Germany, a smaller portion to Sweden. The fish is conveyed by rail, steamers, or boats with wells.

B. ICELAND.—The proceeds of the cod-fishery in 1882 was estimated at 20,000,000 lbs., and the value at 4,000,000 crowns. The fish is cured in two ways; the so-called "Klipfisk" is exported mostly to the south of Europe, whilst the so-called "Platfisk" or "Stokfisk" forms the principal article of food of the inhabitants. The herring fishery produced last year about 50,000 barrels, value 1,300,000 crowns. Another important branch of fishery in Iceland is that of the Hâkal, or Greenland shark (*S. borealis*, Scoresb.), of which the liver yields a great quantity of oil.

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[*] "Vaad" means a fishing-net generally, but especially a net which is thrown out from a boat or near the shore and then dragged in.

[†] "Nedgarn" is a term used for all nets where the fish is caught by entangling in the meshes.

C. THE FARÖ ISLANDS.—The fishery is of the same description as that of Iceland, and the proceeds in 1882 were stated to be 4,000,000 lbs. of fish, worth 800,000 crowns. In some years a considerable revenue is derived from the capture of pilot whales (*D. globiceps*), large shoals numbering sometimes as many as 2000 being occasionally driven on shore and killed.

D. GREENLAND.—The native population of Greenland, which on the 1st of January, 1882, amounted to 9752 individuals, subsist entirely on the chase of marine mammalia and birds, and on fishery. 2100 kajaks, 2400 nets, 250 large boats, and 270 sledges, with their complement of dogs, are employed, and the annual take may be estimated at 90,000 seals, 15,000 sharks, besides a quantity of small whales, salmon trout, halibut, and cod.

HAV. V. FIEDLER.

FRANCE.

THE term Maritime Fishery is applied to operations carried on at sea, on the coasts and salt lakes, and also to that of rivers, streams, and canals, up to the limits of the Maritime Inscription.

This fishery is exempt from dues and rents, but it is from among those engaged in it that the State recruits crews for its men-of-war. The fishermen are in this respect included in the Maritime Inscription after having been engaged afloat at coast-fishing for two years or less.

In 1881, which is the date of the last statistics compiled by the Department of Marine, 80,875 sailors, manning 22,125 ships and smacks, with a tonnage of 149,297 tons, were employed in fishing; besides which, 55,485 riparians (men, women, and children) practised fishing on the banks.

The figures above quoted comprise not only the fisheries of the French Coast, but also cod-fishing off Newfoundland, Iceland, and the Dogger Bank, as well as herring and mackerel fishing on the coasts of Scotland, England, and Ireland.

Taken as a whole, the year 1881 was not so productive as the year preceding. In 1880, in fact, the value of the produce captured reached the sum of 86,917,668 fr. In 1881 only 82,670,058 fr. was valued.

The diminution, 4,247,610 fr., may be traced exclusively to the sardine fishery grounds, from which the returns show, as compared with the year 1880, a falling off of six million francs.

The Newfoundland cod-fishery was prosecuted in 1881 by 137 vessels, manned by 5165 sailors, who captured 17,683,289 kilogrammes of fish, realising 7,882,255 fr.

In Iceland the same fishery employed 202 vessels and 3436 men. The take of cod was 9,695,411 kilogrammes, selling for 5,876,607 fr.

The herring-fishery was very successful during the season of 1881, 39,101,845 kilogrammes of this fish, valued at 9,055,352 fr., having been captured on the coasts of Scotland, England, and France. It would have been more prolific still had it not been marred by bad weather, which inflicted losses both of men and effects on several vessels.

The fisheries for fresh fish, which comprise turbots, brill, soles, plaice, flounders, rays, gurnets, mullets, whiting, congers, salmon, lampreys, sturgeons, etc., were carried on by 72,274 sailors, manning 21,786 smacks,* and the take was 49,940,026 kilogrammes of fish, realising 32,216,487 fr.

374,985,770 oysters were dredged during the season 1880–81 (i.e. between 1st September, 1880, and 15th June, 1881). These fetched 2,061,753 fr. The *total* number of oysters disposed of during the same period amounted to 680,372,750, and the money obtained for them to 17,951,114 fr. This total includes those fished from the sea and those gathered from the artificial breeding grounds or "parcs."

The following table shows the number of piscatorial establishments existing on the 31st December, 1880 and 1881, respectively. This table also shows the gradual development of oyster culture, the principal centres of which are found in the 3rd and 4th maritime arrondissements (Departments of Morbihan, Charente Inférieure, La Vendée, and the Gironde).

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* In this number are comprised boats engaged in fishing for herrings, mackerel, sardines, anchovies, oysters, mussels, other shell-fish, and prawns, and those employed in special services. These vessels carry on in turn one or other of these different industries.

The Department of Marine endeavours to ameliorate the condition of fishermen. Those among them whose apparatus are lost or spoiled by bad weather receive grants to help them replace their fishing tackle, if they are unable to do so out of their own means. Besides this, the fund for disabled sailors awards help to the families of those who are lost at sea, and in the different ports along the coast there exist benefit societies for fishermen.

In France the maritime fishery is regulated in such a manner as to secure to sailors the free exercise of their calling, awarding to them at the same time financial protection when help of this kind can be usefully given.

NOTES AND DATA CONCERNING SEA-FISHING AT BOULOGNE-SUR-MER.

Official documents issued annually by the French Government prove that the Boulogne port and fishing station ranks as No. 1 in the comparative series of the 61 districts into which the sea-coast of France has been divided for administrative purposes.

According to the latest statistics published, the sea fisheries for the whole republic in 1881 gave employment to 80,875 men on board 22,125 ships and boats, of 149,297 tons aggregate burden, resulting in sales of fish to the amount of 82,678,058 fr., or close upon three million and a quarter pounds sterling.

In this grand total the share credited to Boulogne station is entered at 10,439,605 fr., or over £416,000, which represents nearly one-eighth of the total produce of French fisheries.

Next after Boulogne, with regard to the amounts realised, come Fécamp with 5,342,687 fr.; Dunkirk, with 4,521,748 fr.; and Honfleur, with 2,285,425 fr.; then Douarnenez, with 2,654,609 fr.; St. Malo, with 2,625,718 fr.; and St. Brieuc, with 2,562,660 fr.; none of the other ocean, channel, or Mediterranean fishing stations realized £100,000 for that year's produce.

Deep-sea fishing operations are carried on at Boulogne by a flotilla of ships and boats manned by crews of 18 to 22, including two or three apprentices or boys. The yearly earnings of the fishermen, whether they share in the profits of each venture when working upon the partnership system, or are paid by fixed wages, average 1500 fr.; or £60.

The boats, which for the largest proportion are luggers, have for the last 10 years been supplied with small steam-engines working a capstan used in raising the nets, hoisting the sails, taking up and setting the masts, and landing fish or barrels. Experiments were also tried for a few years with screw-propellers; but these have almost universally been discarded, because the engine, shaft, and coal-bunkers took up too much of the available space, and the screw itself fouled and damaged the nets and gear.

The fishing trade in Boulogne is concerned with every branch of sea fisheries;—cod, herring, mackerel, and "*La Marée fraîche*," which includes every description of fresh table-fish.

The ships used in the cod-fisheries range between 100 and 150 tons. Until quite recent times they proceeded both to Iceland and the Dogger Bank; but Iceland has only been resorted to of late years by one or two ships, whereas a large increase is to be noticed in the number of those working the Dogger Bank grounds; thus, in 1882, 59 ships were fitted out, and their operations yielded 574,000 fr., out of a total sum of 598,652 fr., realised by all the cod-fishing boats in the district. The Dogger Bank is preferred before Iceland, because the men can carry on what is styled *mixed fishing* (*La Pêche mixte*), namely, both cod and herring at the same time.

Herring is the main stay of the trade; in fact it realised in 1882 a total sum of 5,778,944 fr., as shown by the sales effected in the Fish Exchange. The introduction of cotton nets, in lieu of twine nets, has resulted in larger catches of fish, and their use now is all but universal for herring drifting, although they nearly all are English made. In two or three French ports cotton fishing-net factories have been established; but even these must procure their cotton from England.

Mackerel are caught off the south coast of Ireland, and salted on board at once. This is quite a recent branch of the Boulogne deep-sea fishing ventures, being first started about the year 1868. It was carried on in the 1882 campaign by 52 boats manned by 966 fishermen, and their catches, exclusive of mackerel kept in ice and landed at Boulogne, sold for 425,227 fr., mostly at Fécamp, which is the recognised market for that description of *salaison*, all attempts made to establish a trade for salt mackerel at Boulogne having met with indifferent success.

Fresh table fish, usually called *La Marée fraîche*, give employment all the year round to two kinds of craft: (1) small undecked boats hailing from little ports in the district, Berck, Cucq, Etaples, Equihen, Le Portel, Ambleteuse, Audresselles, &c., which are worked chiefly by superannuated seamen and by apprentices; (2) the larger decked boats, after they have returned from their deep-sea fishing ventures, and as a sort of aftermath. Both the large and the small number about 300, of nearly 4000 tons, manned by 1800 hands. They brought into the market in 1882 fresh fish of a total value of 4,097,592 fr.

To the various items above must be added a sum of 179,505 fr., as the value of in-shore fishing, including shrimping, mussel-gathering, crab-catching, &c., which, considering that it frequently does not require the use of boats, bears the official name of *Pêche à pied*, because it is practised by old men, women and youths on foot.

The French fisheries are occasionally supplemented by imports from abroad, Great Britain being the only country which brought up fish into France *viâ* Boulogne. Thus, in 1881, 170,535 kilog. of fresh herring and 1,255,313 kilog. of other fresh fish were landed and passed from England, besides 3564 kilog. of smoke-cured herring, and 3416 kilog. of sundry kinds of wet-cured fish.

The most sedulous attention and care have of late years been brought by the Boulogne fish merchants and curers to bear upon the various modes of preparing fish for the home and foreign markets, whether curing operations were conducted on board their boats afloat or in their town establishments. They thus have secured new outlets for their produce, not only throughout France and in conterminous countries, such as Switzerland and Italy, but in far more distant regions, for instance, the Baltic provinces and the United States of America: they even have established a remunerative trade in England itself, and in Ireland.

Sea-fishing is beyond contest the prime and most precious industry of the Boulogne district, inasmuch as numberless trades, callings, professions, and industries are dependent upon it to such an extent as to swell the total returns of the operations connected with sea fisheries in the station to one million pounds sterling a year.

Neither is this the sudden result of adventitious inflation; it must be held as the steady regular development of an ancient condition of things, which from small beginnings has culminated to this brilliant climax. Going no further back than the year 1821, it is on record that fishing operations realised 1,287,712 fr.; they nearly doubled their returns within the next decade, yielding 2,211,675 fr. in 1830, and then 2,500,000 fr. in 1843; in 1868 they sprang up to 7,091,724 fr., and advanced to 9,668,827 fr. in the decade following; they now stand at 10,439,605 fr. for 1882.

The chief causes which have thus made Boulogne the largest, foremost and most prosperous fishing station in France, may be stated briefly in the manifold improvements systematically adopted by the fish merchants and shipowners of the district, which concerned both the size, lines and rigs of the boats and the nets, in the introduction of steam power, and in the new markets opening abroad year after year for produce of a higher character.

Dredging operations, which have now been persevered in for more than a twelvemonth at the mouth of the harbour, with a view to clear away the sand bar which obstructed it, and sundry other operations not yet fully completed in the fairway, have already resulted in opening the harbour to the fishing flotilla, and to a large portion of merchant ships, for 17 hours daily out of the 24.

There is a sure promise held out and on the eve of realisation, that within a few months the harbour of Boulogne,* frequently but unjustly reckoned as a mere fishing port, will be made accessible all day long, and without let or hindrance, not to fishing ships and boats alone, but also to the large merchantmen, both sailers and steamers, which usually resort to its wet dock for the purpose of taking up or discharging their cargoes. So even before that grand undertaking, the deep-sea harbour, now constructing in the west of the present tidal harbour, is ready to receive the shipping, free access to and exit from the present harbour and docks of Boulogne, regardless of the state of the tide, will be secured and realised.

Among the various items contemplated and prepared in connection with that scheme of an ocean harbour intended to supersede the present tidal harbour, special landing quays and stages have been devised for the fishing flotilla which has placed and maintains Boulogne at the head of the whole list of the fishing stations in France.

(*Compiled by the Department of the Minister of Marine in Paris.*)

FISHING ESTABLISHMENTS IN EXISTENCE ON THE 31ST DECEMBER 1880 AND 1881 RESPECTIVELY.

ESTABLISHMENTS.	NUMBER.				AREA.				KEPT.							
									By enrolled mariners, their wives and children.				By persons not enrolled.			
	Public Domains.		Private Property.		Public Domains.		Private Property.		Public Domains.		Private Property.		Public Domains.		Private Property.	
	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.
					hect. a. c.	hect. a. c.	hect. a. c.	hect. a. c.								
Fishery establishments in permanent structures .	924	935	—	—	1487 47 61	1491 12 41	—	—	578	580	—	—	3341	3353	—	—
Establishments for net fishing . .	1154	1175	—	—	106 18 00	108 28 00	—	—	611	615	—	—	453	468	—	—
Parks, beds, and preserves for oysters . . .	30,591	32,364	957	970	7734 03 69	8050 39 66	368 60 76	375 69 83	10,116	10,706	115	118	17,293	17,841	755	766
Mussel beds . .	5356	5568	—	—	1243 50 00	1264 70 00	—	—	2325	2338	—	—	2593	2610	—	—
Parks or depots for Mussels . . .	805	836	18	18	136 45 35	140 54 98	3 60 00	3 60 00	1356	1376	—	—	2194	2205	18	18
Tanks or preserves for Crustaceans .	83	92	1	1	3 76 60	12 36 82	3 24	3 24	32	36	—	—	26	29	1	1
Fish tanks . . .	—	—	1621	1626	—	—	1171 48 60	1174 19 23	—	—	82	84	—	—	1463	1466
"Bodigues" . .	—	—	32	32	—	—	—	—	—	—	—	—	—	—	—	—
"Madragues". .	16	15	—	—	—	—	—	—	1	1	—	—	11	10	—	—
Total . .	38,929	40,985	2629	2647	10,711 41 25	11,067 41 87	1543 72 60	1553 52 30	15,019	15,652	197	202	25,911	26,516	2237	2251
Increase for 1881 .	2056		18		536 h. 00 a. 62 c.		9 h. 79 a. 70 c.		633		5		605		14	
Decrease for 1881 .	—		—		—		—		—		—		—		—	

GERMANY.

THERE are many advantages in the geographical position of the German Empire which considerably favour fishery and its cultivation. The vast extent of the south coast of the Baltic, with its multitude of useful fish, which abound still more towards the south-west, wholly falls within the limits of the German Empire, while the coasts of Schleswig-Holstein, Hanover and Oldenburg afford a considerable seaboard on the German Ocean. The wide estuaries (Haffs), covering an area of 401,956 hect., and formed by the great rivers which flow into the Baltic combine the advantages of both salt and fresh water, and thus greatly contribute to the success of fishery. The country may be divided into six large river districts created by the Rhine, Danube, Weser, Elbe, Oder, and Vistula. In these rivers and their numerous tributaries every variety of flowing water is to be found, from mountain rivers and torrents replete with all kind of salmonoids down to the sluggish streams in the plains, with their multitudes of valuable cyprinoids. Along the southern boundary of the empire, the Alpine slopes have formed that group of mountain lakes which by their matchless beauty delight every tourist, yet, however important these may be on account of their extent and the abundance of fish they contain, they are surpassed in importance by the endless number of lake-like formations to be met with in the eastern portions of the plains of Northern Germany, partly isolated, partly connected with each other, or with neighbouring rivers; these lake-like formations are of the highest value for the purposes of fishery. The river Drewenz (to take a single example), which is 200 kilomètres in length, connects 123 lakes of this description in its course through East and West Prussia, whereby the migration of fish is greatly facilitated. The area of these lakes exceeds 20,000 hect., and the fauna of the combined sea and river system comprise salmon, sturgeon, trout, grayling, smelt, the small maraena, perch-pike, pike, perch, pope, lamprey, and of the large tribe of the cyprinoids, carp, tench, dace, barbel; finally large numbers of eels, and particularly fine crayfish. It must be understood that this district is not exceptionally favoured by piscatorial advantages; on the contrary, the percentage of the area occupied by these waters to the total area of the district will show that their extent is not above the average area covered by water in other parts of the empire. The average percentage in the seven eastern provinces of Prussia is 4·3; in the provinces of East and West Prussia alone it is 7·4; in Posen 2·0; in Brandenburg 3·0, and in Pomerania 7·7. These natural advantages must have led the people of Germany to take up fishing at a very early period. Indeed, pre-historic discoveries have brought to light surprising facts, which show how closely connected with the dawn of civilization was the practice of fishing. With the advent of historic times, we find in records, statutes, names of towns, escutcheons, and many other things, increased testimony that fishing was a highly important factor in the economy of the nation. The history of later periods brings to light facts such as these: viz. that fishery was to a great extent the source from which the Hanseatic League derived its power, and by which its commercial instincts were encouraged: that the German Order during its colonizing efforts in heathen Prussia, bestowed a care and skill on the regulation of fishery in many respects worth emulating even at the present day, and that the people felt so keenly the gradual restrictions and alterations in the original right of free fishing, that the claim for the restitution of this right occupied a prominent place in the programme of the great social movement which agitated the peasants in the sixteenth century. In the following centuries the cultivation of fishing, in common with national economy generally, suffered a great relapse, which for a long time retarded an advance from mere promiscuous fishing to that more methodical system which aids nature, partly by trying to increase the stock of fish, partly by making proper and rational use of them. It is only very recently that the sense of the advantages of this system has returned, and at the present moment fishery associations are established in all the Confederate States of Germany, foremost among them being Prussia. These associations, which are uniformly supported by the German "Fischereiverein," and a daily increasing number of private fish-breeders of experience, vie with each other in performing their task. The beginning of this movement dates from the Prussian Fishery Laws of 1874. Although difficulties of no ordinary kind stood in the way of legislation on this subject, yet the legislator, backed by the unanimous verdict of all parties entitled to express an opinion as experts, has attained his object. A diversity of views exists as to the provisions of the provincial fishery laws passed on the basis of the general law above cited. A special subject for criticism has been the principle newly introduced by these subsequent laws of an *absolute* close time, i.e. an annually recurring period during which not only are restrictions imposed on the capture and sale of specific classes of fish, but during which all fishing operations are prohibited in certain waters or parts of the same. In whose favour the balance of opinion will at length turn, whether the new principle will prevail, or whether the old system of enforcing a close time for certain species will be resorted to, cannot at the present time be predicted; but it is certain that the ultimate decision will guide the course of legislation in the other German Confederate States. The desire of an uniform settlement of fishery questions, in conformity with generally accepted views, is a strong one throughout the empire, and is shared by the different governments. Statistics have not been able to keep pace with the rapid progress that fishing has made in late years. Many of the statistical data collected in former years have now become antiquated, and are no longer in accordance with the actual state of things. To cite these data without commentary, for which there is no room in this paper, would obscure a clear survey of the subject. This applies even to deep-sea fishing, which is naturally carried on under more stable conditions. Suffice it therefore to state that the German fisherman is again becoming accustomed to look beyond the narrow field of operations afforded by the coast, and to push his ventures farther into the open sea. His endeavours to show greater energy than hitherto are actively furthered by the State, especially in the case of Prussia; vessels better suited for the purpose are built, fishery associations are encouraged; the network of railways is being extended for facilitating a rapid supply to the interior of the country; tariffs have been reduced, new contrivances for transporting fish invented, harbours of refuge constructed for the fishermen; everything in short has been done to enable them to carry on their business steadily and without interruption. A satisfactory settlement of the question of the Berlin Market Halls, which may be looked for at an early date, will act as a powerful lever in the encouragement of deep-sea fishing. It is however true that much is still to be desired as far as the consumption of fish is concerned. The widely entertained prejudice against the consumption of fish not brought alive to the market is a great obstacle to a reduction in price, and one which mainly prevents a larger consumption by the lower classes. The supply of sea fish and fresh-water fish uncooked or prepared for consumption, remains in the country, and is insufficient to meet the demand. Only in those Prussian provinces which border on Russian Poland is a brisk export trade across the frontier carried on. It is right however to state that the export, principally from Berlin, of crayfish to France and Belgium has assumed extraordinary dimensions. The number of crayfish annually exported from that city is estimated as being at least thirty millions. Among the means of improving inland fishery, artificial fish-breeding has acquired a foremost place. Originally a German invention of the eighteenth century, it has been improved upon by other nations, and in its new shape has now become firmly established in all parts of Germany. The German "Fischereiverein" has made this system a basis for all its exertions, and consistently abides by the principle which it has laid down in the two following sentences—"An jeder Mühle muss wenigstens ein Kalifornischer Trog arbeiten;" * and, "Ueberall in das rechte Wasser der rechte Fisch." †

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* "A Californian hatching-box must work at every mill-dam."

† "Everywhere the proper fish into the proper water."

Consequently an animated circulation of different species of fish is carried on throughout all parts of the country; the perch-pike and maraena are translated to the west and south; the eel and salmon are to try to acclimatise themselves in the Danube, the Alpine lakes enrich those in the eastern low-lands with trout and coregonus of the best breed. The indigenous species are being augmented by imports from abroad, especially by various American salmonoids. At the same time natural breeding retains its place. Experiments with multitudes of naturally-bred young cyprinoids are more and more resorted to and promise good results. The cultivation of ponds, which sank from a highly flourishing state in the Middle Ages, after the abolition of monasteries, is now recovering the ground it lost; and the carp—to mention this fish only as an instance of the direction now given to pisciculture—is shown the way of improving his species by the introduction of carefully selected kinds from other localities. Germany, though somewhat hesitatingly at present, is following the example of England in endeavouring to render rivers again passable for migratory fish, and the problem how to prevent the pollution of rivers more effectually than hitherto, without encroaching upon the lawful interests of other industries, is now occupying learned as well as unlearned heads. One thing, unfortunately, is yet in the initial stage of its development—the sport of angling. This kind of sport, at least when viewed from a sportsman's standpoint, is a thing almost unknown; for the public are mistaken in assuming that what is commonly practised in Germany as the art of angling, is the genuine prototype of this noble art. Much of its decline may be attributed to shooting, which in Germany especially is such a powerful rival to other forms of recreation. Nevertheless signs of an improvement in this respect are happily discernible, more particularly in Southern Germany, where the votaries of genuine angling are daily on the increase. The time may not be very far off when the German sportsman, jostled by a throng of fellow-devotees, will with some sadness look back upon the day when he with his fishing-rod was the lord of boundless and magnificent tracts of water.

GREECE.

THE fisheries of Greece, on account of the numbers of persons who gain their living by this trade, hold a prominent position in the country. But these products, barely sufficing for the daily consumption, do not influence foreign trade. Even in the smallest ports there are some fishing-boats which practise fishing either by the net, drag-net, or line. The population living by fishing is comparatively large, but we do not know the exact figure, having no official statistics on this point.

There are in Greece twenty-four establishments for pisciculture, which are the property of the state. The lease of these establishments is put up for auction by the public treasury every ten years. The best of these establishments are installed in the lagoons, which extend over a space of more than 30 square kilomètres, in front of the town of Missolonghi. Two-thirds of the population of this town earn their living by fishing, and above all by a kind of pisciculture, that is, retaining the fish in the lower lakes by an enclosure, and afterwards capturing them just at the moment when, eager to spawn, they seek to regain the open sea. The weight of the fish thus reared, and afterwards caught, amounts to more than 600,000 kilos. a year. The fish are sold fresh in the market of the same town, or that of the neighbouring town, Patras (Achaia). The preparation of salt fish is only carried on on a very small scale. 'The best and most appreciated product of the country is the *Boutargue.* What is thus designated consists of ovaries full of the mature eggs of the *Mugil Cephalus,* salted and afterwards dried by exposure to the air. In three ports of the country, Corinth, Chalcis, and Cræoi, they practise, especially in summer, the sardine anchovy, and scomber-mackerel fishing—fish that are here always salted. Last year was very unfavourable for this fishing, and it was with difficulty, even in the three above-mentioned ports, that they could muster a thousand barrels of salt fish of 40 kilos. on an average. This fishery has supplied the trade with more than 10,000 barrels. Last year a hundred boats, manned with crews amounting to three hundred and fifty men, remained without employment.

At Spezzia one hundred and fifty men, manning twenty-five boats towards the month of May, devote themselves to the tunny fishery by means of a net expressly made for this kind of fish, of which the produce amounted to 7000 kilos. in the last cruise, which was sold fresh in the market of Nauplia at the rate of fr. 1·50 per kilo. This fishery, owing to the number of persons engaged in it, is rather important, and it is to be hoped that it may be introduced to other parts of the coast. The fish that chiefly supply our markets are the red gurnet (*Mulus fuscatus et barbatus*); *Dentex vulgaris et macrophthalmus; Chrysophrys aurata; Pagellus erythrinus mormyrus;* smarides (*Smaris vulgaris*); mullet (*Mugil cephalus, capito saliens labio chelo et curtus*); whiting (*Merlangus poutassou*); hake (*Merlucius vulgaris*); *Golius jojo niger auratus, etc.;* (*Epinephelus gigas*); *Labrax lupus; Lichia glaucus;* sardines and anchovies; *Salpa box,* &c., &c., and others in smaller quantities. Not having great fisheries in the country, we have no laws or special rules respecting them. There are laws, however, for the protection of the young fish, prohibiting the use of certain machines, and above all the drag-nets and seines (*pêche dite au bœuf*), and the use of narcotic plants deleterious to fish, such as the *Verbacum sumatum*, L., and the *Euphorbia dendroides*, L., as well as explosive materials. The fishermen are subject to all the sanitary laws, and rank in the class of coasters; they are thus under the protection of the law and the treaties, provided that the coasting-trade and the fishing are licensed Hellenic citizens. There is in Greece another maritime industry, which cannot be separated from fishery properly so called; it is the sponge fishery, which provides nearly all the world with these articles of domestic use. This fishery is practised in three different ways, by diving apparatus, by harpoon, and lastly by single divers. Five ports in Greece exclusively furnish all the sponge fishermen. They are the ports of the Island of Egina, Hydra, Hermione, Kranidi, and Trikéri.

Of the boats employed in this fishery, 183 are used for the diving apparatus and 540 for harpoons and divers. Their crews form a total of 3160 souls.

Fishing is principally carried on in the Ægean Sea, in the canal of Crete, and near the coast of Africa (Barbary and Tunis). The finest sponges are found in Grecian waters, particularly by the divers.

The produce of this fishery increased last year to about fr. 2,400,000. The sponges are sold principally in France and England.

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HAWAIIAN ISLANDS.

THE FISH AND FISHERIES OF THE HAWAIIAN ISLANDS.

THE Hawaiian Archipelago, otherwise Sandwich Islands—a portion of the great Polynesian area—are eight in number, not reckoning some small rocky islets. They lie between 18° 55′ and 22° 15′ N. lat., and 154° 42′ and 160° 32′ W. long. Their origin is volcanic, and they rise from an elevated plateau in the Pacific, having a depth of 1000 fathoms of water above its floor. Their shores are frequented by numerous species of fish and marine animals, and were formerly visited by whales. Sharks abound, and are caught in numbers by the bold and ingenious natives, whose habits are very amphibious. They seek the shark in coves and caves below water, whilst the gorged fish sleeps with his head forced into the sides of its resting-place. The diver slips a noose round the tail of the shark, which is then hauled up and dispatched. A *kanaka* has been known to secure in this manner six or eight sharks in a day. The oil extracted from them is valuable and of good quality. The fish used for diet consist principally of the mullet, the most delicate of all, the albicore, the bonito, the flying-fish, the eel, a species of mackerel, and the cuttle-fish. The two curious inhabitants of those deeps, the *Chalcedon imperator* and the *Zeus ciliaris*, are figured by Lady Brassey in her 'Voyage of the Sunbeam.' Of crustaceans there are crabs, prawns and shrimps; and of molluscs, the pearl-oyster, or rather *Mya*, and various shell-fish, but the common oyster is not found there. There was formerly some trade in pearls, but they were not of large size, or fine quality and the search for them now is almost or quite given up. To a people whose diet consisted principally of vegetable substances, fruit and fish, preservation of the last alive, after capture, was an important object. The double canoes, in old times so common, had between them a vessel or basket for containing the living fish. Fish-ponds enclosed from the sea by a wall, somewhat similar to the *viviers* on the French coasts, abounded, some of them being of very great size. Numbers of such ponds still exist in the estuary or mouth of the Pearl River. The fish-ponds formed by some of the Hawaiian kings were really gigantic works. Of other marine creatures, large quantities were taken of the *bêche-de-la-mer* (*Holothuria*, or sea-slug). When dried it formed an article of export, the Chinese being its principal consumers. The Hawaiians are not now so greatly dependent on the sea for food, since the introduction of cereals and foreign articles of consumption; nevertheless, in places near the sea, *poi* and fish—the latter often eaten raw—form the staple of their diet. To an essentially littoral people "the agriculture of the sea" is a subject of very great importance. Lady Brassey remarks ('Voyage of the Sunbeam'), that "almost everybody they saw had half-a-dozen or more brilliant members of the finny tribe, wrapped up in fresh green banana leaves ready to carry home." The piscary laws and customs were severe and rather complex. The absolute despotism of the kings, the arbitrary power of the chiefs, and the extraordinary effect of *tabu*, pressed heavily on all Hawaiians, and especially those who dwelt on or near the coasts. Yet there was a certain degree of reason in those laws and the manner in which they were used. The king had universal rights in his feudal dominions, and was lord of the land and sea; but he did not always and everywhere exercise those rights, and the customary laws were not altogether unfitted for the state of society then prevailing. As the Hawaiian people, early in the present century, emerged into the light of civilisation, the monarch generously put aside his feudal rights, and fashioned his government on the constitutional pattern. In 1839 he signed a bill of rights, and in 1840 conferred a constitution on his people. Statute laws soon followed; the first volume which contains them is dated in 1846. The regulations relating to fisheries are very precise. To the king were reserved certain royal fish wherever they were caught; some had limitations. Thus the bonito was his if taken off any part of the coast of the island of Lanai; the albicore, off Hawaii; the mullet, off Hulcia; the squid and freshwater fish at Mana on Kauai. Many other fish are specified in the prerogative, but as only their native names are catalogued, they fail to be recognised here. The king was entitled to one-half of the take of these fishes. Then there were the rights of the landlord of the soil and of the sea as far out as the reefs. On his private or prohibited fishing-grounds he could reserve one species as his peculiar property. Provision was made against the fish of the king and the landlord becoming intermingled; in which case the former received two-thirds as his share, but this only in certain localities. No fish might be taken during the *tabu.* When it was announced by proclamation that this season was over, the people might take "protected" fish on their delivering one-half to the appointed agents of the king. He had vast *viviers* which had descended to him, or which he had himself constructed. Most of the islands are surrounded by a reef. Outside the reef there was free fishing for the natives. Within the reef, the littoral and riparian landowner had rights extending to the reef; or in places where no reef existed, his property in the waters went out one mile from the beach. Generally the proprietor named one species for his own, and let his tenants and others take what they could of the rest. The *tabu* acted at proper seasons for the preservation of the fish quite as effectually as the restrictions of our close months do on the fisheries of our own country. The landlord having chosen for the entire year the species or variety of fish he set apart for himself, has to give notice by *viva voce* proclamation to the tenants and other persons residing on his lands, and to signify the same to the Minister of Interior in writing. Also a list of all the fish appropriated by the landlords is to be inserted once in English and Hawaiian, in the Polynesian newspaper. When the article relating to the royal fishing rights is invaded, the offender is, on conviction, to forfeit all fish found in his possession; and, in addition, to pay five-fold for all fish taken, or to be put in confinement at the discretion of the court. As to trade, previous to the last half century the Hawaiians had nothing that might claim the name of commerce. They sold or bartered pigs and fowls, fish and vegetables to the vessels which, few and far between, refreshed themselves on their shores. A transient trade had, indeed, existed with the Chinese in sandal wood, insomuch as that Hawaii was known in China as the Sandal-wood islands. But this source of profit came to an end by the reckless cutting down of the trees. Later on, salt was made on their shores, and in 1870, 2513 tons were exported, but in 1881 the quantity had diminished to some 500 tons. About fifty years ago a new and profitable but demoralising industry sprang up, namely, the landing and transhipping of oil in the group. The whaling vessels of the Pacific and the tranships called there, and more than three hundred visits have been received in a single year. These had to be supplied, and money and money's worth became abundant. The first whale ship belonging to Hawaii was fitted out in the year 1834. A record of the oil and bone landed and unshipped shows in the year 1851 the following quantities, viz.:—sperm oil, 104,362 gallons; whale oil, 909,379 gallons; whalebone, 901,604 lbs. The trade culminated in the year 1858, when there were of sperm oil, 222,464 gallons; whale oil, 2,551,382 gallons; bone, 1,614,710 lbs. The trade then declined, so that in the year 1874 it records only, sperm oil, 37,812 gallons; whale oil, 312,305 gallons; bone, 104,715 lbs. The whales in the nearer ocean had, in fact, been over-fished, and had changed their habitat to more distant grounds. This was the result of the same improvidence which had ruined the sandal-wood trade, and is in other places destroying india-rubber and other natural productions. A few whalers still put in occasionally at Honolulu, and in 1880 are reckoned, among domestic exports, 14,662 gallons of oil, and 10,917 lbs. of bone. The rise in agricultural industry, however, more than compensates for the harvest of the sea. The export of sugar from the islands in 1882 was 51,000 tons and 221,000 gallons of molasses; 5400 tons of rice and paddy, and other productions in smaller quantities were also exported.

ITALY.

I. INTRODUCTION.—Owing to the time and space conceded, this must be considered merely as a very condensed essay on the subject. Italy cannot be said to possess any of the grand fisheries and extensive fish-cultural establishments of Northern Europe; our seas are numerically richer in species, but far less so when the number of individuals of important food-fishes comes to be considered; and our fresh-water fish-fauna is certainly poor in game-fish, while our rivers are relatively few and small. It must, however be borne in mind that the fisheries of few countries, and of none in Europe, present such a variety as those of Italy. A vast amount of information on the subject is contained in the five big volumes, '*La Pesca in Italia*,' edited by Professor A. Targioni Tozzetti, and published by Government (Ministry of Agriculture, Industry and Commerce) between 1871–74. The matter contained in this publication was principally collected by local committees, in order to bring together the information necessary for the compilation of a uniform fishery legislation. The first three volumes are dedicated to sea fisheries, the two following to fresh-water fisheries; the arrangement of the contents, owing to the special object in view, and consequently to the system followed in collecting the materials, is somewhat defective, and inevitable repetitions occur; yet the amount of most valuable information on the former fishery legislation, local privileges and traditions; on the divers fisheries, nets, implements and boats used; on the social condition, manners and customs of fisherfolk on the different parts of the Italian sea-coasts, lagoons, lakes and rivers; and the number of documents, edicts, &c., some of special historical value on the subject, collected, is very great. Professor Targioni Tozzetti published besides a condensed, but yet lengthy, report on Italian Fisheries, as an Introduction to the Official Catalogue of the Italian section at the Berlin International Fisheries Exhibition in 1880 (*Esposizione internazionale di Pesca in Berlino.* SEZIONE ITALIANA. *Catalogo degli Espositori e delle cose esposte,* pp. xvii.-cxxxvi. FIRENZE, 1880). Besides, different reports on special fisheries have been published from time to time by Government. From these different sources I have collected much information, without which my task would have been no easy one.

II. FISHERY LEGISLATION, PAST AND PRESENT.—As a natural consequence of her long political division, few countries up to quite a recent date presented such a varied and large amount of edicts, laws and regulations relating to fishery, some dating back to the earlier part of the Middle Ages, as Italy. A large series of big volumes would be required to collect the documents relating to past Italian fishery legislation, and a varied and singular collection it would prove, interesting besides as bringing down to our days some of the piscatorial traditions of the ancient Greeks and Romans, curious from a linguistic point of view as a medley of corrupt Latin, mediæval Italian, Spanish and local dialects. I may quote amongst the more remarkable of such documents the innumerable decrees of the Republic of Venice, relating to fishery and pisciculture in the lagoons and *Valli.* One of the earliest bears the date 13th August, 1314; and the curious Red Book (*Libro Rosso*), regulating to the smallest details all fishery matters of the inner sea (*Mare picollo*) of Taranto, which dates positively further back than the fourteenth century. Many such documents were originally emanated to establish feudal rights, which afterwards became the heirlooms of municipalities or devolved to the State. From the earliest periods of any social status, piscatorial and maritime matters have been much mixed up together, and fishermen and sailors regulated by identical laws; on regaining her liberty and completing her unity, Italy sought in the first place to render as much as possible homogeneous and uniform the varied legislations up to that period regulating the status of the different parts of the country now brought together; the promulgation of the Civil Codex of the new kingdom of Italy was shortly followed by that of the mercantile navy, and in this last was clearly established that while all the disciplinary regulations relating to fishermen and fishery along the sea-coasts, more especially on account of the maritime conscription and registration of boats, were to depend on the central naval administration (Ministry of Marine), all that related to the economy of fishery were to depend on the Ministry of Agriculture, Industry and Commerce. On the other hand, in the case of fresh-water fisheries, the latter Ministry was brought in contact both with the Department of the Interior and with that of Public Works. Next came the laborious task of collecting all the necessary materials for a uniform and general Law on Fishery; it was the labour of several years, during which harbour masters, chambers of commerce, provincial and municipal deputations, special local and a central general committees, worked away with a will. The result was the present Fishery Law, which bears the date of 4th March, 1877; it consists of four chapters and twenty-four articles, and is drawn up in a liberal spirit. Much more difficult was the compilation of the bye-laws or regulations necessary for the administration of the new law; a first general committee drew up instructions for such regulations, a draft of which was submitted to special local committees, and the results of the work of the latter brought before a new central committee, composed of competent persons, who finally formulated the Regulations for Sea and for Fresh-water Fisheries, promulgated on the 13th of June, 1880. The regulation for sea-fisheries consisted of ninety articles divided into six chapters, that for fresh-water fisheries of thirty-five articles and five chapters. Local wants and special cases have been carefully provided for, and a truly liberal spirit pervaded the whole; yet, on application, many serious difficulties arose, often where least expected: protests and petitions came in from different parts of the country, relating to several articles of the new bye-laws, but more especially directed against the restrictions placed on trawling. A permanent *Consultive Fisheries Committee* composed of competent persons—members of parliament, professors of zoology, and government officers—had meanwhile been named by royal decree; to this committee devolved the task of examining the objections to and petitions regarding the new fishery regulations, and that of providing for special cases that had been overlooked or not sufficiently provided for. Much labour was got through by single members, and in two general meetings of the Fisheries Committee, and the results were new and revised regulations both for sea and fresh-water fisheries, the first of which, promulgated on the 13th of November, 1882, appears to have met with the requirements of most fishermen, and to guard sufficiently the preservation and propagation of the more important species of food-fishes. It consists of ninety-nine articles divided into six chapters. The new regulation for fresh-water fisheries is now ready. Such is a very summary account of the actual state of fishery legislation in Italy.

III. SEA FISHERIES. *A. General.*—1. *Fishermen.*—Not everywhere along the Italian sea-board do fishermen, as in other parts of Europe, form a separate and well-defined class; the reason of this must be sought in the comparatively small importance of special fisheries, both in the Mediterranean and in the Adriatic. Along many miles of our coasts fishing is done in a desultory manner by old men, women and children, who do any other sort of work besides, while the able-bodied men are away at sea or as workers in naval yards or elsewhere; in some localities the inhabitants do not fish at all. But exceptions always exist, and one of the most remarkable cases is that of Chioggia, near Venice, where the entire male population, except infants, is engaged in fishery, and passes a large portion of the year away from home down the Adriatic to the Ionian Islands. On the southern Italian coasts of the Mediterranean fishing populations are also met with, and as especially so may be quoted the inhabitants of the Ponza Islands, Ischia, Faro (Messina), Trapani and Taranto. As a matter of course, special fisheries are usually in the hands of special classes of fishermen, as those of the thunny, anchovy, and precious coral. 2. *Boats.*—A bare enumeration of the different kinds of boats used for sea fisheries along the coasts of Italy would fill up many pages, I shall therefore merely mention the commoner classes. The first comprises the smaller boats known by the names of *battelli, barche, gozzi, schifi,* and *schifetti;* they vary in capacity from half to four tons, in length from six to twelve mètres, are keeled but not decked, carry oars and a small mast with a lateen sail, and a small jib (*pollaccone*); they are only used at a small distance from the shore for minor fisheries and do not carry generally more than four or five men. In the second class may be included larger boats, from five to sixty tons burden, completely decked and carrying from five or six to ten or twelve men; they have usually two masts and carry at least three sails, one a big lateen. These boats can perform pretty long sea voyages, and often go for fishing purposes at a considerable distance. There are many varieties of this larger sort of fishing boats, but the most notable are the singular *Bragozzi* of the Adriatic, remarkable for the shape of their hull and their strange sails coloured in brown or deep red, and covered with quaint figures and strange devices; next come the *paranze* or *paranzelle* of the Mediterranean, far less showy and characteristic. These boats generally work in pairs and mostly use trawling-nets. 3. *Fishing Implements.*—The number and variety of these is very great, and rendered apparently more so on account of the different terms used for the same implement in different parts of the country, so much so that at one of the general meetings of the Fisheries Committee the writer proposed a resolution, which was passed, desiring Government to have a synonymical and descriptive list collected and published to facilitate the application of legislative measures. The nets used are of many kinds, but may be classed in two principal divisions, viz., standing and trawling-nets (*reti da posta e reti da strascico*). It is quite out of the question that I should here enter into a concise description even of the principal varieties. I can merely state their names. To the first series belong the following:—*Manaida Manaidozza, Si-*

gnorella, *Vollaro*, *Mugginara*, *Tramaglio*, each having special varieties according to the species of fish for whose capture they are used : thus there is a *Manaida* for anchovy, another for sardine, a third for *Atherina*, a fourth for Pelamid, and a fifth, called *Squadrara*, for small sharks and angel fish (*Rhina*). Besides, the special nets which form the *Tonnare* belong to this division. Trawling-nets are much used and of many varieties. I may mention as more generally in use the following :—*Tartana*, *Tartanone*, *Tratta*, *Sciabica*, *Sciabichella*, *Bragagna*, *Coccia*, *Rezzuola*, *Mazzonara*, *Agugliara ;* they principally differ in size and in the manner they are worked. Some are drawn by hand in shore, others by a single boat, others by two boats sailing. To this division may be added the *Bilancia*, *Retequadra*, and *Giacchio* or throwing net. Lines and hooks are also much in use, and often very complex concerns, having different names according to the number of hooks, their size, &c. ; the best known go by the names of *Filaccioni*, used along the coast, and *Palamiti* or *Palangresse*, used in deep-sea fisheries. Traps of different sorts are used for large crustacea, especially lobsters and go under the generic term of *Nasse.* Harpoons (*Fiocine*) of different shapes are also in use, especially for capturing the sword-fish, chrysophrys, &c., and in the curious nocturnal *lampadara*-fishery. Special implements are employed for the capture of mollusca and shellfish and for dredging precious coral. Illegal modes of capturing fish are besides but too often resorted to : thus dynamite (*torpedini*), cocculus, and the mela terragna (*Cyclamen*), used in the capture of rock-loving fish, with the *Chiusarana* along the Neapolitan coasts. 4. *Marine Animals*—These will be classed systematically. *a. Seals and Whales.* These do not afford any special fishery in the Italian seas. The Mediterranean seal (*Pelagius* *monachus*), found also along the S.E. shores of the Adriatic, is by no means common and rarely captured; they are mostly taken alive with nets placed at the entrance of the grottos they are known to frequent, and sold to showmen, who exhibit them alive. True whales are of very rare occurrence, only one authentic capture of the all but extinct Basque whale (*Balæna biscayensis*) is on record, and took place at Taranto on the 9th of February, 1877; one instance of the capture of *Balænoptera rostrata* is also known, near Villafranca, in February, 1878. Rarely, too, has the fin-backed whale (*B. musculus*) been caught or stranded. Sperm whales (*Physeter macrocephalus*) have occurred now and then in both seas, and occasional specimens of *Ziphius cavirostris*, *Orca gladiator*, *Pseudorca* (?), *Grampus griseus* and *Globicephalus melas* have been taken. The common cetaceans in the Italian seas are dolphins (*Delphinus tursio* and *D. delphis*), who often cause great damage to fishermen by destroying their nets, so much so that those of the Ligurian coast lately petitioned Government that a prize might be awarded for the capture of dolphins; these are not sought for, although their flesh is eaten along the Adriatic, but near Palermo there is an establishment where they are boiled down for oil, together with the heads of thunnies and other refuse of that fishery.

b. Turtles. One species alone may be called common, it is the *Thalassochelys corticata*, sold as coarse food in the markets of Southern Italy; two other species, *Chelone viridis* and *Sphargis coriacea* occur, but are extreme rarities.

c. Fish. Of the 460 species known to inhabit the Mediterranean and Adriatic seas, most are sought for by fishermen and used as food; I need only except: *Centriscus*, *Argyropelecus*, *Coccia*, *Maurolicus*, *Gonostoma*, *Chauliodus*, *Scopelus*, all Lophobranchs, *Orthagoriscus* and *Branchio-*

stoma, as unfit for human food; the Elasmobranchs are all eaten, even the larger species of sharks which are sent to inland markets, and cut up, sell well. As I before remarked, the Italian seas do not afford many cases of large and important special fisheries, and those few will be quoted further on. I may here add that the most esteemed game-fish, as the Americans style them, are furnished by the following genera: *Labrax*, *Serranus*, *Dentex*, *Mullus*, *Sargus*, *Pagrus*, *Chrysophrys*, *Scorpæna*, *Trigla*, *Sphyræna*, *Ruvettus*, *Trachinus*, *Umbrina*, *Sciæna*, *Lepidopus*, *Scomber*, *Pelamys*, *Orcynus*, *Brama*, *Coryphæna*, *Lichia*, *Seriola*, *Xiphias*, *Merluccius*, *Rhombus*, *Solea*, *Engraulis*, *Clupea*, *Conger*, *Muræna*, *Acanthias*, *Mustelus*, *Raja*. Very abundant, but sold as cheap food for the poorer classes, are species of the following genera: *Mæna*, *Smaris*, *Box*, *Pagellus*, *Trachurus*, *Gobius*, *Lophius*, *Blennius*, *Atherina*, *Mugil*, *Labrus*, *Crenilabrus*, *Pleuronectes*, *Arnoglossus*, *Belone*, *Rhina*, *Torpedo*. In concluding I may remark that there is a notable difference between the fish-fauna of the Mediterranean and that of the Adriatic, the latter has a much more northern character: flatfish abound and attain a greater size, and some genera and species common in that sea, as sturgeon (*Acipenser*), *Gadus euxinus* and *Pleuronectes italicus*, are unknown or very rare in the Mediterranean. *d. Crustacea.* Most of the numerous species inhabiting our seas are used as food, even the smaller ones; but setting aside the Mediterranean lobster (*Palinurus*), of which I shall speak hereafter, I need only mention those genera which are more often met with in large quantities at our fish-markets, thus: *Maia*, *Cancer*, *Calappa*, *Eriphia*, *Homarus*, *Scyllarus*, *Palæmon*, *Penæus*, *Nika*, *Næphrops*, especially in the Adriatic, and *Squilla*. *e. Mollusca.* Most species of Cephalopods are commonly used as food and sold at the markets along both coasts, but while the tougher species of *Octopus*, *Eledone*, and *Sepia* are classed as coarser sorts and sold cheap, the more tender *Sepiola* and *Loligo* fetch higher prices and are much esteemed. A large number of shell-fish are used as food in Italy, and nowhere so well as at Naples, along S. Lucia, may the inquirer satisfy his curiosity on this point; besides the common oyster, of which anon, the tables of the "*Canolicchiaro*" show the following genera, often represented by more than one species: *Solen* (Canolicchi), *Solecurtus* (Lattari), *Donax*, (Tonninole), *Venus*, *Cytherea* and *Tapes* (Vongole), *Cardium* (Cocciole), *Pecten* (Canestrelli), *Pinna* (Madrepole; besides *Mactra*, *Mytilus*, *Modiola*, *Arca*, *Spondylus*, *Lithodomus* and other Lamellibranchs. Univalves are also richly represented by species of the genera: *Patella*, *Haliotis*, *Natica*, *Nassa*, *Murex*, *Tofa*, *Dolium*, &c., &c. *f. Echinoderms.* This class also furnishes food along the sea-board of Italy, and in the markets near rocky coasts may often be seen baskets of sea-urchins (*Echini*), of which the following species are commonly eaten: *Echinus melo*, *E. lividus*, *E. brevispinosus*, and *E. saxatilis*. *g. Cœlenterata.* Two species of sea-anemone are used as food, and commonly known under the name of "*Ogliole;*" they are *Actinia viridis* and *A. equina*. Other members of this division are the object of special fisheries, but not for the table; they are precious coral and sponges, and will be mentioned by and by. *B. Special.*—1. *Tunny Fishery.*—This is our most important special sea-fishery, and although the common tunny (*Orcynus thynnus*) is the principal item of this industry, not a few allied species are caught by the same means and treated in the same manner. I may mention the following: *Orcynus brachypterus*, *O. germo*, *Thynnus thunnina*, and *Auxis Rochei*, all sea fishes, which periodically and successively visit in large numbers different parts of our coasts: thus a precise knowledge of the direction and epoch of such migrations was necessary for establishing the localities and seasons where such fisheries could advantageously be undertaken. The principal tunny fisheries on the Italian coasts (*Tonnare* and *Tonnarelle*) are: S. Margherita (Liguria), Marciana and Enfola (Elba), Porto S. Stefano (Tuscany), Bivona and Pizzo (Calabria), Portoscuso, Portopaglia, Isola Piana, Calavignara, Flumentorgiu, Alghero, Saline, and Trabucato (Sardinia) Olivieri, S. Giorgio, Vaccaro Pepe, Marsamemi, Capo Passaro, Favignana and Formica (Sicily). In the Adriatic tunnies are caught, but I know of no regular *Tonnara* except that of Prelucca near Fiume. The methods used in catching tunnies do not differ much, but the *Tonnare* are of various size and extension; they consist of a series of large chambers closed in by strong netting, the outer one opens widely in the direction from which the migrating fish are to come and so intercepts them, the inner or last chamber is graphically called *camera di morte* —it can be shut off from the rest and drawn up, and here the killing or *mattanza* takes place, a most exciting but not pleasant scene. Curious traditions regulate the doings, and the special task of each man employed in the *Tonnare*, and these differ slightly in Sardinia and Sicily; in the *Tonnare* of the former island about 1000 men are employed, in those of the latter about 1400; they give together a yearly product valued some ten years ago at between three and four millions of *lire* (francs); the entire product of the tunny fishery on the Italian coasts was valued at the same date at about seven millions of francs annually. The incomplete official returns for 1882 give a total of 39 *Tonnare*, not all at work, and the produce of four of these (Pizzo, Bivona, Ischia and S.

Margherita) is rated at 271,120 *lire.* 2. *Swordfish Fishery.*—This fish (*Xiphias gladius*) is the object of a very peculiar if not extensive fishery on the Calabrian and Sicilian coasts and in the adjacent Straits of Messina, between the months of April and September. These fish, which have the habit of swimming near the surface, and which also travel in considerable numbers in that season, are sighted by look-outs (*antennieri*) usually seated on the very tall masts of peculiar boats (*feluche*), near these are stationed a number of fast boats (*lontri*) with a shorter mast on which is perched the *froriere* who follows the direction shouted and pointed to by the *antenniere;* on the prow stands the harpooner (*lanciatore*), and as the boat is swiftly rowed up to the fish, he throws his harpoon, (*draffiniera*), the wounded fish is followed up by a second fast boat, the first returning near that which holds the *antenniere.* It is a most exciting scene, witnessed once near Messina. It has been described, nearly in the same words, by Polybius and Spallanzani and Ventrioli, at an interval of nigh 2000 years. 3. *Anchovy and Sardine Fisheries.*—These two fisheries, which give yearly a very considerable produce, take place usually during the summer months, and the nets called *manaide* are more frequently used. The anchovy (*Engraulis enchrasicholus*) is caught in greater numbers in the middle and southern parts of the Mediterranean, and especially amongst the Tuscan islands and off the coasts of Sicily; also in the Adriatic, towards the Dalmatian coast. The fishery is practised by fishermen from Chioggia and Ancona. At night, fires are lighted to attract the fish, which keep in shoals. The sardine (*Clupea pilchardus*) is caught in much the same manner and during the same season. Both are usually salted, and a preliminary cure is given by the fishermen themselves in their boats.

To give an idea of the value of this fishery it may be stated that at Palermo alone the produce at one season was 600,000 kilogrammes of sardines, valued at 200,000 francs, and 400,000 kilogrammes of anchovies valued at 400,000 francs, 4. *Hake Fishery.*—This fish (*Merluccius vulgaris*) is commonly known by the name of *Nasello.* It is one of the commonest and most esteemed fish of the Italian seas, and may constantly be seen in numbers, of all sizes, in our markets. In winter it is generally taken by trawling, but during the summer months it appears to retire to deeper waters, and then very large specimens are caught by hook and line, with the *palamiti* or *palangrese;* with it are also taken, in depths varying from 3 to 800 mètres, huge congers, *Mora Mediterranea, Phycis,* and other species. 5. *Whitebait Fishery.*—This special fishery is only allowed, for particular reasons, in a few localities—principally along the Ligurian coast. It is practised with trawling-nets of a very fine texture, and only from January to April. Under the generic name of "whitebait," have been included the "*Rosetti,*" scientifically known as *Latrunculus pellucidus,* and the "*Bianchetti,*" which are the young fry of the anchovy and sardine; the destruction of the latter is certainly detrimental to fishery interests, and ought to be stopped or restricted as much as possible. 6. *Lobster Fishery.*—In the Italian seas the common lobster of Northern Europe (*Homarus marinus*) is rather of rare occurrence, and is replaced by our "*Aligusta,*" or "*Aragosta*" (*Palinurus vulgaris*), the object of a most lucrative fishery on the rocky parts of our coasts, and more especially amongst our smaller islands. Civita Vecchia, Pozzuoli, and Maddalena, in Sardinia, are three of the principal centres for lobster fishermen; these men seek their fishing grounds at considerable distances from their homes; they go in parties in smallish lateen-sailed boats, secure their prey with peculiar nets or basket-traps (*nasse*), keep the lobsters imprisoned under water in much larger *nasse*, and awaiting an opportunity embark them alive, carefully wrapped in wet sea-weed on some passing steamer. I once met several of these fishermen on the small island of Montecristo, they then had over 2000 lobsters which they were preparing to ship to Genoa. 7. *Sepia Fishery.*—From very ancient times the capture of the common cuttle-fish (*Sepia officinalis*) has been the object of a very peculiar fishery on the Southern Adriatic coasts, from Bari to Manfredonia: small bunches of lentisk (*Pistacia lentiscus*), called *vorle*, are tied at intervals to a rope and fixed under water at about 8 or 10 mètres from the shore; the cuttle-fish seek their shelter to deposit their eggs, and are then easily caught. The present law forbids this destructive kind of fishing. 8. *Pinna Fishery.*—Near Elba, on the Sardinian coasts, and especially at S. Antioco, at Taranto, Gallipoli, and along the Sicilian shores, in comparatively shallow water, lives the large and beautiful *Pinna nobilis*, which is sought for on account of its shell, its flesh (eaten cooked), its byssus (from which a singular kind of silk is woven), and the rose-coloured pearls it sometimes contains. It is taken by diving, or more ingeniously with a stone fastened to a string carefully let down into the open valves, which close tenaciously, and the animal is drawn up. 9. *Coral Fishery.*—This is beyond doubt one of the most interesting and peculiar fisheries in the Mediterranean, and deserves a less passing notice than that which I am obliged to give. The coral-fishermen form a peculiar class, and in Italy, hail from S. Margherita (Liguria), Leghorn, Carloforte, and Alghero, (Sardinia), Torre del Greco, Trapani, and Messina; their boats (*corallini*) are also peculiar and of two sorts: the larger from 10 to 14 tons burden, the smaller from 2 to 6; they are decked, and have a mast, lateen sail and jib; a peculiar feature is the large wooden windlass amidships, for hauling up the dredge, called *ingegno:* a St. Andrew's cross about 2 mètres in length, weighted with stone or iron, and garnished with about 30 tangles made of rough netting and cordage; other not less primitive implements are used for disentangling the dredge, should the occasion occur. The larger boats are mounted by a master, an assistant, a steersman, and 8 hands; the smaller ones by 5 or 6 men. The coral grows in suitable localities in most parts of the Mediterranean, Ionian Sea, and South Adriatic; it requires a rocky bottom, and affects especially banks covered with madrepora and shells at depths varying from 50 to 200 mètres, rarely more. The coral-patches or banks are mostly as well known to the *corallari* as are the islands which rise above the sea; the best localities are now off the coasts of Sardinia and in the shallow sea between Sicily and Pantellaria, but no doubt undiscovered coral-banks are yet to be found, though probably not many. During voyages in the Mediterranean *corallini* are often seen at work; In Bonifacio Straits, near Castelsardo, off the W. and E. coasts of Sardinia, but especially between Sciacca and Pantellaria. There, on the extreme edge of the "Adventure Bank," not far from Ferdinandea or Graham's Island, much coral has been got in the last few years, principally off three patches, but mostly dead and blackened, not unlikely killed by the volcanic eruption which caused the above-mentioned island to rise and then disappear in 1831. Many hopes had been raised by the discovery of the Sciacca coral-banks in 1875, 1878 and 1880, and as much coral, though of a very inferior quality, had been got from them, the Government was induced to have them explored. This was partially done at the end of August, 1881, by Professor Ricchiardi. The writer of this was present with him on board the man-of-war steamer *Washington*, and will not easily forget the animated sight of over 300 *corallini* at work, amidst which we steamed on the 30th of August. In 1882 the exploration of those banks was completed, again by the *Washington*, with Professor Canestrini on board; the results were to show that the *dead coral* on those banks had been nearly all fished up. Professor Parona has been recently, by Government order, investigating the condition of the coral-banks of the Sardinian coasts; his report on the subject is now in the press. Precious coral was sought for off the coasts of Northern Africa by the Pisans as far back as the tenth century; its discovery off Sardinia dates from the sixteenth century; off Calabria from the seventeenth century. The produce of this fishery appears to be on the decline. In 1871 only 359 *corallini* boats were registered from Italian ports, Torre del Greco alone sending 307. The men engaged in this fishery numbered 3623, and the mean annual produce was calculated at about 60,000 kilogrammes of good *living* coral, of the approximative value of five millions of *lire* (francs). The produce of the coral fishery on the Sciacca banks from March to October, 1882, as given by official returns, was 19,120 *quintali*, valued at 4,493,200 *lire;* 582 boats and 5766 men were employed. The banks discovered in 1875 and 1878 are quite exhausted; that found in 1880 is expected to yield from 20 to 25 *quintali* per boat during the present season, 1883. It must be remembered, however, that this is all or nearly all *dead* coral of low price. The coral-fishery is usually undertaken from March to October, but in some parts, weather permitting, it takes place at all seasons. 10. *Sponge Fishery.*—This industry is principally in the hands of Adriatic fishermen, and undertaken amongst the rocky islands off Istria and the Dalmatian coasts; a certain number of Sicilian fishermen are, however, employed in this fishery off the Tunisian coast near Sfax. The species sought are; *Spongia mollissima,* the most valuable, *S. adriatica* (?), *S. zimoca, S. equina;* the methods employed are two—diving and trawling.

IV. LAGOON AND ESTUARY FISHERIES.—These fisheries which in all respects form a connecting link and occupy an intermediate position between salt-water and fresh-water fisheries, have a special importance in Italy on account of the number and extension of salt and brackish-water lagoons near the mouths of rivers or elsewhere; such are the extensive *valli* of Comacchio, Codigoro, and those further north joining on to the Venetian lagoons; the large Sardinian *stagni,* as those of Cabras (Oristano) and Cagliari; the *stagni* of Orbetello and Burano in Tuscany, that of Lesina in Puglia, and others; and in a way the *Mare piccolo* of Taranto. Fish, crustacea, and mollusks are the product of these fisheries, which also give occasion to a special kind of pisciculture, of which anon; I need here only dwell especially on some of the former as yielding the more valuable produce. Many species of crustacea are taken, and I may mention *Carcinus mænas,* one of the more abundant, used however chiefly as bait; while *Eriphia spinifrons, Crangon vulgaris,* and *Squilla mantis,* are esteemed as food. The more remarkable mollusks belong to the genera *Sepiola, Sepia, Cerithium, Gibbula, Solen, Tapes, Cardium, Mytilus,* and *Pecten.* Not a few fishes generally considered marine enter the brackish water lagoons and live and thrive there in company with other species usually classed amongst freshwater creatures. I may mention the genera *Labrax*, *Mugil*, *Atherina*, *Solea*, *Pleuronectes*, *Esox*, *Leuciscus*, *Anguilla*. In purely salt-water lagoons some of the finer sorts of game sea-fish abundantly resort, as *Mullus*, *Chrysophrys Umbrina*, *Corvina*, *Rhombus*, and several species of *Gobius*, especially *G. paganellus* and *G. ophiocephalus*. The special fisheries of greatest economic value undertaken in Italian lagoons and estuaries are the following. 1. *Grey Mullet Fishery.*—The genus *Mugil* is richly represented in our Ichthyofauna; the six species, *M. cephalus*, *M. capito*, *M. auratus*, *M. saliens*, *M. labeo*, and *M. chelo*, are common, the first four abundant, and live not only in the sea but frequent brackish waters and enter rivers. In some of the *valli*, lagoons and *stagni*, their capture is on a very large scale, and gives a notable produce; a peculiar net, the *mugginara*, is usually employed. Prof. Targioni Tozzetti graphically describes one of these fisheries, which he witnessed at Cabras in Sardinia; the proceedings resembled on a smaller scale those at a *Tonnara*, but the men dived and seized under water the mullets imprisoned in the *mugginara*, the scene being a most curious and exciting one; on that occasion 1200 kilogrammes of fish were secured and considered a poor result. 2. *Eel Fisheries.*—The common eel (*Anguilla vulgaris*), with its many varieties and sub-species, is one of the most common fishes in Italy; it is caught in the sea, in brackish waters, and in fresh water, but more especially in lagoons and estuaries, and affords one of the more important items of our fisheries. It is now well known that the eel reproduces itself at sea, the young fry entering rivers and lagoons in myriads, and along the coast between Leghorn and Viareggio, in canals leading from the sea into the Arno and adjacent lagoons. This gives occasion to a most peculiar fishery, that of the *Cechə*, such being the name given to these young vermiform and semi-transparent eels. During the months of December, January, and February, they swarm in countless numbers in such localities, where, for special local reasons, their capture is allowed during the period designated. In the so-called *lagune*, *campi*, or *valli* of Comacchio, extensive salt and brackish water lagoons at the delta of the Po, between the branches called *Po di Volano* and *Po di Primaro*, eel fishery is an ancient and important industry. Only the adults are caught, and principally at two periods, autumn and Lent. To give an idea of the produce, I may state that the *valli* belonging to Comacchio alone give a mean annual produce of 825,000 kilogrammes of *preserved* eels, valued at 735,000 *lire*. In 1871, 1,307,558 kilogrammes of eels were got.

V. FRESH-WATER FISHERIES.—I have already stated the reasons why these are not of great importance in Italy; except in the northern portion of our country, the rivers are insignificant and the lakes of small extent; the fresh-water fish fauna is besides not rich in species of economic value, such as elsewhere in Europe form the object of an important piscatorial industry, as salmon and sturgeon are entirely wanting or not abundant. As I have before mentioned, for obvious reasons, special regulations, distinct from those relating to sea fisheries, regulate those in rivers and lakes. The fishermen on fresh waters are far less distinct as a class than those who seek their living on the sea, yet in some localities they also form a distinct part of the community. The boats they employ, with their flat bottoms and inelegant shapes, rarely rowed, and more often poled, are very different from the sea-going ones. Again, the nets they use are often different and always of smaller size. In fresh waters it is easier to employ illegal methods for capturing fish; and various poisonous substances, such as cocculus, euphorbia, lime, &c., besides dynamite, have but too often decimated the finny inhabitants of many a streamlet or pond. *a. Amphibia.* The frog (*Ranaesculenta*) forms in Northern and Central Italy a not unimportant item of the small gains of the fresh-water fishermen; especially in spring and autumn they are brought alive in thousands to the market. They are classed with the finer sorts of freshwater fish, the fleshier parts of the hind legs being considered a delicacy by many. *b. Fish.*—A most marked contrast exists between the freshwater fish fauna of Northern and Peninsular Italy. South of the Apennines the species are few and of slight importance—small trout in the mountain streams, carp, tench, barbel, rudd, and a few other *Leucisci*, with the ubiquitous eel, nearly complete the list, and barely afford a precarious living to their captors. The more important rivers and larger lakes of Northern Italy are better stocked, and give opportunities for a larger piscatorial industry. The most esteemed species are: perch, *cottus gobio Lota vulgaris*, trout, grayling pike, shad, and sturgeon. In the larger lakes of Lombardy, and more especially in Lago Maggiore and that of Garda, lake-trout of large size (*Salmo lemanus* and *S. carpio*) are caught in considerable numbers; and again the shad (*Clupea alosa*) of two varieties: one resident, known as "*Agone*," the other migratory, entering rivers from the sea in spring, called "*Cheppia*." The Po and Adige are besides periodically visited by numerous sturgeons (*Acipenser sturio, A. huso, A. Naccarii*, and *A. Nardoi*), some of which attain a very large size. *c. Crustacea.* The common crayfish (*Astacus fluviatilis*) is pretty common all over Northern and Central Italy, but of late years it has been nearly exterminated by a curious epidemic, manifest in an infusorian which fixed itself in countless numbers over the branchiæ, finally preventing respiration. Crayfish-culture has not, it is believed, yet been attempted in Italy, where it might easily succeed. In Central and Southern Italy a fresh-water crab (*Telphusa fluviatilis*) is pretty common and sought for; near Florence they are kept for some time in the dark, isolated in earthern jars, so that they shed their carapace, and becoming soft are more easily eaten. *d. Vermes.* The common leech (*Hirudo medicinalis*) found in most parts of Italy, was in past years, when more extensively used for medicinal purposes, eagerly sought for; between 1828 and 1851, the authorities of Sardinia, Rome, and Parma, issued special edicts for its protection. No later documents with that object have been noted, but in the neighbourhood of Turin leeches are specially reared for medicinal use.

VI. PISCICULTURE.—This important branch of industry is as yet in an incipient condition in Italy, whereas it has of late years made such rapid strides in other countries; and yet in this, as in many other things, we may and can look further back than most nations, and recall the time when our forefathers, the Romans, had such tender cares for their *piscinæ*, *vivaria*, *murænorum*, and *cetaria*, and reared oysters in Lake Lucrinum,* carrying them thither from the far shores of Brundusium and Tarentum.† Of late, however, some progress has been made, and the future promises well. 1. *Fish Culture in Lagoons.*—This is a very peculiar kind of industry, the first step towards true artificial fish-culture; it is most extensively practised in the salt and brackish-water lagoons which occupy so large a surface between the mouths of the rivers Reno and Isonzo, on the Adriatic coast, and goes by the generic term of *callicoltura.* It originated in the peculiar nature of that extensive region, and dates back far into the earlier part of the mediæval times, for in the archives of Venice documents exist relating to lagoon-fishery of Chioggia dated 888. In the year 1118 and 1181 *piscariæ aquæ* are mentioned, and in 1425 documents relating to *clausura vallorum* appear. Up to the present time much has been written on *Vallicoltura* in the Venetian provinces, but especially the recent concise publications on the subject by Dr. Renier and by Count Ninni. The latter, who knows more about the matter than most men, exhibited a most complete and interesting collection of models of boats, nets, implements, &c., used in the Venetian lagoon-fisheries, at the Milan Exhibition of 1881, *Vallicoltura* is practised in much the same manner in the *valli* of Comacchio, Codigoro, Chioggia, Venice and Caorle. It consists in dividing and partitioning the outer and inner lagoons, using natural formations and artificial structures, such as embankments, palisades, &c.; the adult fish who resort to lagoons for spawning purposes, and more especially the young fry who enter from the sea in search of food, are thus protected, divided, and at the right time captured. The system of division and subdivison in the *valli*, especially in the inland ones, is very complicated, and as this industry is most important and of quite a peculiar nature, I am sorry for want of space to be prevented from giving further details. The *valli* are classed into—*valli arginate, valli arginate in parte,* viz., partially closed by reed-palisades (*grisiole*), and *valli chiuse,* or completely closed by *grisiole*; locks or *chiaviche* regulate the communications and the water supply. The natural entry of fish-fry from the sea into the lagoons goes by the name of *montata*, and the more important *montate* take place from February to May (*Mugil capito*, *M. auratus*, *M. chelo*, *Labrax lupus*, *Chrysophrys aurata* and *Anguilla vulgaris*), and in August and September (*Mugil cephalus*, *M. saliens*, *Mullus*.) A peculiar feature in this industry is the so-called "*Semina del pesce novello*," literally "sowing of young fish." It consists in capturing in fine nets along the coast or in the external lagoons the young fry of the species above mentioned, and in carrying it to the inner waters or closed *valli*, that it may grow and be fished at the proper time. The utility and expediency of such proceedings has been for the last two centuries an object of discussion amongst the *Vallicultori*, some of whom up to the present day opine that the natural *montata* and its facilitation is the true system of *valli*-culture. To give an idea of the value of the present lagoon-fishery and pisciculture, we may add the statement of Count Ninni, who in 1881 writes that in the northern lagoons alone (between Porto Fossone, Adige, and the mouth of the Isonzo) 600 boats and 25,000 fishermen are employed in this industry; and he adds that these data are rather below the true number for both. Quite a series of boats, nets and implements of various kinds are used in *Vallicoltura*, and the men therein employed have each their special task. 2. *Fish Culture in Fresh Waters.*—I include under this term the artificial propagation and introduction of important food-fishes; in this line little indeed has as yet been done in Italy. The first attempts were made in 1859, in the small lakes of Trana and Avigliana in Piedmont, by Professor F. de Filippi and Sir James Hudson the British ambassador at Turin; eggs of lake-trout, Salvelin and salmon from Huningen were introduced, and the following year to these were added those of *Coregonus* from Lake Bourget and of Geneva; unfortunately, on account of the absence of Prof. de Filippi, first in Persia, and then in a voyage round the world, during which he died, the work was discontinued before any results could be obtained. In 1861 de Filippi went to Lake Constance, on purpose to fecundate eggs of *Coregonus lavaretus;* 600,000 of these were thrown into Lake Como at Colico, and about a million in Lake Maggiore, some being incubated at Avigliana, others at Baveno, with Coste's system. Again, in 1862, Government acquired 70,000 fecundated eggs of the Salvelin from Kuffer (Saltzburg), 25,000 were kept at Avigliana, others at Baveno, to be placed in Lake Mergozzo, and 5000 destined for Lake Montorfano (Como.) As I said above, these operations so well begun were unfortunately not continued. However, in April, 1881, a *Coregonus* of large size was caught in Lake Maggiore, evidently one of those introduced from Lake Constance. In 1861, at Venaria Reale, H.M. King Victor Emanuel initiated a small fish-cultural establishment, now obsolete. In 1864-65 Dr. P. Carganico made a similar attempt for trout at Como. In 1871 Dr. Revelli founded a piscicultural establishment for trout and salmon at Savigliano; this succeeded in part, but eventually failed, simply for want of pecuniary support, in 1879. An attempt of a similar nature, on a larger scale, was made at Isola della Gaiola near Naples, by a Signor De Negri; this also failed through want of money. In 1878 Messrs. Turri and French commenced the artificial propagation of trout in one of the mountain streams near S. Marcello (Pistoia), and although entirely dependent on their own private means, have been thus far successful. Again, the Agrarian Committee of Bardolino (Verona) have decided to found a piscicultural establishment on Lake Garda; on this project the Fisheries Committee reported favourably. Finally, Government has begun the formation of a small piscicultural establishment for trout in the Royal Forestal School at Vallombrosa, in order to impart practical instruction in the matter to those students. Before concluding, it should be mentioned that a successful piscicultural establishment has been working, since 1879, at Torbole near Riva (Tyrol). 3. *Oyster and Mussel Culture.*—The inner sea of Taranto (*Mare piccolo*) and Lake Fusaro, near Naples, which had lost its ancient renown but appears now in a fair way of regaining it, are the principal centres of oyster culture in Italy; the species reproduced is *Ostrea edulis*, several varieties of which are known. Prof. Targioni Tozzetti calls the Taranto oyster *O. lamellosa.* The young oysters are collected in the autumn on bundles of branches, which had been purposely immersed during the preceding spring in suitable localities in the *Mar Grande* at Taranto, weighed down with stones; these young, called *cria*, are inserted into loosely twisted ropes (*pergolari*) made of *Spartium*, which hang from the larger ropes supported on piles which form the *sciaja*, such being the name of the quadrangular spaces in the *Mare piccolo* especially allotted for this oyster culture. The oysters thus transplanted are fit for eating after eighteen months or two years, during which the *sciaje* are carefully kept clean. These oysters, becoming adult, spawn, but the young larvæ thus produced do not thrive, and the *sciaje* must be kept up by new *cria*, procured, as I have described, in the *Mar Grande.* The mean yearly produce of the *sciaje* of Taranto is valued at six millions of oysters, priced from five to six francs the hundred. The Taranto oysters are beyond doubt amongst the finest I have seen and tasted anywhere. A small oyster culture exists also in the Faro Lagoon, near Messina. At Taranto again, and also in some of the Venetian *valli*, the edible mussel (*Mytilus edulis*), and especially at Taranto, the more esteemed *Modiola barbata*, are largely cultivated. In the *Mare piccolo* of Taranto the same system is used as that practised for oysters. The reserved spaces are, however, called *quadri*, enclosed, as the *sciaje*, by piles driven vertically down ; the bigger ropes are called *libani*, and the dependent smaller ones with free extremities again *pergolari* ; the latter usually number nearly 6000 in each *quadro*. The young mussels, also called *cria*, are carefully collected and inserted into the purposely uncoiled *perpolari*, where they fix themselves with their byssus. In about eighteen months, during which they are carefully kept clean, the *pergolari* being regularly *aired* to kill parasites, they attain maturity. An average *quadro* may thus produce about 150,000 kilogrammes of mussels, of the approximate value of 17,000 *lire* (francs), including expenses. The entire produce at Taranto has been calculated at 16,000 *quintali* per annum. In November, 1881, the writer was at Taranto, and visited the oyster and mussel culture establishments on the *Mare piccolo*, but found their owners in great distress; unusually violent storms a few days before had committed great havoc amongst the *sciaje* and *quadri*, which those poor people were busy cleansing and repairing. Quite recently my friend Professor A. Issel, of Genoa, has published by Government order a valuable treatise on oyster and mussel culture (*Istruzioni per l'Ostricoltura e la Mitilicoltura*, GENOVA, 1882).

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* Murice Baiano melior Lucrina peloris.—(Horace, *Sat.* 2, iv.)
and
† Pectinibus patulis jactat se molle Tarentum.—(Ibid.)
will at once occur to our schoolboys.—[ED.]

VII. CONCLUSIONS.—The rapid and synthetical account now concluded has, we trust, succeeded in giving a fair though very general idea of Italian fisheries. Here and there are given a few statistical data, but it must be borne in mind that such data can only be approximative. I should have wished before concluding my task to have given more statistical data, such being considered now-a-days the manner of expressing the conditions of industrial undertakings and many other matters, but few will contradict the assertion that of all sources of produce, fisheries are beyond doubt those to which it is most difficult to apply that test, for obvious reasons. During the first session of the Fisheries Committee, I had to report on this very subject, viz., "*How to obtain annual statistics of the produce of Fisheries;*" then, as now, my conclusions were that the problem is a most difficult one, and can never be thoroughly solved. I may, however, add some general returns, the result of the inquiry for collecting materials for the law on fishery between 1869 and 1871, giving them for what they are worth. From the report on fisheries then presented to Parliament, I quote the following data: The number of men engaged in sea-fisheries on December 31st, 1869, with the exclusion of the then Papal States, was 60,000, employing 18,000 boats, and giving a mean annual produce valued at 40 millions *lire*. It does not appear that any statistics were then collected for the important lagoon and estuary fisheries, and the results relating to fresh-water fisheries are far from complete; they gave the numbers of fishermen at 3000, and the value of produce at between 3 and 4 millions of *lire.* For the sea-fisheries the best source of information were the maritime inscriptions, and they may easily give erroneous results for the special object in view. In 1878 the official returns give the following data: Fishery products *exported*, 39,887 kilogrammes, value 3,259,670 *lire;* fishery products *imported* 44,060,300 kilogrammes, value 21,479,740 *lire.* These data cannot be much altered now, and show an immense difference in favour of imports, a proof that our consumption is not balanced by our produce. At present our fisheries, as an industry, considered *en masse*, cannot be said to prosper, but no doubt better days are in store, and will come for this as for other Italian interests; the actuation of the new law on fishery, and the untiring exertions of government to aid and protect individual enterprise, cannot but lead to good results. The *bibliography* relating to Italian fish and fisheries is rich and extensive ; a valuable contribution on that subject was collected by Dr. Cavanna for the Berlin International Fisheries Exibition in 1860 and published at Government expense.

PROFESSOR HENRY H. GIGLIOLI,
Commissioner of the Fisheries.

ROYAL ZOOLOGICAL MUSEUM, FLORENCE,
April 12, 1883.

NETHERLANDS.

HERRING FISHERY.—The principal branch of this great fishery of the Netherlands is carried on in the North Sea annually from the month of June to the beginning of November, its special localities being in the vicinity of the coasts of Scotland and England; also in the latter portion of the season, in a more southerly direction near the Dutch coasts. In this calling there are occupied a great number of smacks, luggers and cutters, nearly all issuing from the ports of South Holland, besides the so-called "bomschuiten" vessels, which, owing to the necessity for their being dragged along the shore, are furnished with a flat bottom instead of a keel. The fleet, after a long period of decline, has improved since 1857, when Holland abolished the system of premiums, and put an end to all kinds of protection for the fisheries and left them unrestricted. The number of hookers, luggers and cutters was 89 in 1867, and in 1881 had increased to 139; the number of "bomschuiten" likewise increased from 189 in the former to 269 in the latter year. Besides this, the tonnage of the different vessels gradually became larger, so that they now take out to sea more nets than was formerly the case. The tonnage of the luggers gradually increased from 147 to 235 cubic metres, and that of the boats from 90 to 100 to 140 or 150 cubic metres. The luggers and cutters are manned by fourteen or fifteen hands; the boats by ten or eleven. The whole fleet consisted in 1881, of 408 vessels, measuring 19,800 tons (each of 2·83 cubic metres), and were manned by 4,840 sailors. The captured herrings are for the most part cured almost immediately after they are taken, and on board ship, while another portion are first salted prior to being smoked and sold as red herrings to the trade. The production has of late years remained prosperous, consisting in 1880 of about 227 million and in 1881 of about 197½ million of fish, representing a market value of between 3 and 4 million guilders. The principal destination of the salted herrings is Germany, the smoked ones being sent to Belgium. Similarly with the production, the export has also remained steady. The export of cured herrings increased from 80,000 barrels in 1872 to 134,600 barrels in 1881, and 139,500 barrels in 1882. The abolition of, the official brand to which Holland agreed in 1878, far from hampering the home trade, has given it a remarkable impetus from that period. On the other hand the export of smoked herrings has decreased from about 68 million head in 1872 to 41½ million in 1881. This diminution is however solely due to the circumstance that so high a price is now obtained for the cured herring that a smaller part of the whole capture is now consigned to the smoking room than was formerly the case. Besides those caught in the North Sea, Holland obtains considerable quantities of herrings from the Zuider Zee. This fishery, which begins in the month of October, continues to March or April, but is often delayed for months by frost, keeps perhaps a thousand small vessels in employment, each of which is manned by two or three men, who bring their take daily to the shore. The produce is very irregular, but may be set down at from 40 to 50 million fish. These herrings are of much inferior quality to the herrings from the North Sea. They are either smoked singly, though last year high prices were obtained from them fresh, in which state they are largely used by the poorer classes. If the capture is a very large one, large quantities of them are often used for manure.

SALT COD.—The smacks and cutters which in the summer carry on the herring fishery, are occupied during the winter in the capture of cod-fish with hooks and lines in the vicinity of the Dogger Bank, the cod being principally prepared as salt fish. The not very profitable results obtained from this fishery—a consequence probably of the high price of the bait—is no doubt the cause why many of the ships during winter either lie still or engage in the capture of *fresh* fish. On the contrary there are in Holland about fifty other vessels, each with a crew of thirteen men, which carry on exclusively the capture of cod and shell-fish, and during a part of the winter join the fleet which fishes on the Dogger Bank and bring away the salted produce. The returns of this fishing has of late years varied between 20,000 and 25,000 barrels, while the export of salted cod amounted in 1881 to 575,000, and in 1882 to nearly 894,000 kilogrammes; Belgium and Germany are almost exclusively the consumers of this article.

FRESH FISH.—Next to the herring fishery the capture of fresh fish is the principal one in Holland. The fish are sometimes caught with hooks, but more frequently with trawls and other drag nets. In this fishery all the "bomschuiten" of the coast take part during the winter, and some of the luggers which carry on the herring fishery in summer; also the fifty large vessels referred to above, and all sorts of other vessels great and small hailing from the small towns along the coast.

The complaint of scarcity, especially in regard to flat fish, becomes gradually more general, but it should be noted on the other hand that extravagantly high prices are obtained for fresh fish, so that the prosperity of fishermen is now on the whole greater than was formerly the case. A great part of the fish is exported, more particularly for Belgium. In the last three years the following quantities were exported:—1880, 6,959,000 kilos.; 1881, 4,800,000 kilos.; 1882, 4,311,000 kilos. These figures however do not include the export of shrimps, which in 1882 mounted to 1,178,000 kilogrammes, nearly all of which quantity was sent to England. In the Zuider Zee are caught, in addition to herrings as above stated, anchovies, plaice, congers, and shrimps. The anchovy fishery, which, from May to July employs some 1200 boats, is in fortunate years the richest product of the Zuider Zee. The harvest is however extremely uncertain, for while in abundant years it sometimes amounts to over 70,000 baskets each of about 3,500 fish, in poor years the whole may be put down at 1000 baskets. During the last six years the catch has been extremely small.

CULTURE OF SHELL-FISH.—Oyster breeding in the province of Zeeland, until lately unimportant, has during the last fifteen years increased considerably, thanks to the particular care bestowed on the enrichment of the beds and the high price obtained for the produce—of late years from 60 to 65 guilders per thousand. In 1881, 21,800,000 oysters were brought to market, half of which quantity was sent to England, while the other half was either retained for home consumption or sent to the Belgian and German dealers. Next to that of oysters, the production of mussels is very important, both in Zeeland and in the Zuider Zee. From the last-named sea there were sent, in 1881, to England, *via* Harlingen, 11½ million kilogrammes of this shell-fish.

SALMON FISHERY. The fishery of salmon in the Dutch rivers is now in a very satisfactory condition, not only on account of the rich catches, but also in consequence of the very high prices obtained for the supplies. At Kralingen, a village in the neighbourhood of Rotterdam, which is the centre of this trade, there were sold in 1882 55,079 head. The prices fetched varied from about f. 7 to f. 1 per kilogramme. The greatest harvest in the last decade was in 1874 (77,070 head), the lowest in 1879 (38,914 head).

FUNDS FOR FISHERMEN.—At the principal fishing ports there exist funds called "rents" for the maintenance and education of the widows and orphans of fishermen who are drowned. These funds are partly kept up by voluntary contributions, and partly by contributions by masters of vessels and by fishermen.

J. F. BUYS,
Secretary to the College for Sea Fisheries
in the Netherlands.

NORWAY.

LIVING in a country whose soil was poor, and which was surrounded by the sea, the Norsemen, immediately after their immigration from the south or the east, began to utilise this sea, which abounded in fish of different species. But fishing did not satisfy them long; the riches of the southern countries drew their minds towards those happier regions; the woods which covered their mountains and hills offered them the principal materials for attaining the fulfilment of their desires; and at the same time, when the history of Norway begins in the eighth century, the annals of Germany, England and France, mention the Norse Vikings as plundering their coasts. In the following century we find them in Ireland, where they founded several states under their chiefs (sea-kings), and in the Mediterranean, and in 870 they discovered and peopled Iceland. From here they went to Greenland; and in the year 1000 Leif Eiriksson and his followers established themselves in Massachusetts, which they called *Vinland*. But the Norse colonists could not resist the great number of natives, and being, moreover, at variance, they soon returned to Iceland, from whence they seem to have kept up communication with the new world for the next forty or fifty years. In the middle ages the mighty Hansa-confederacy ruined the Norwegian shipping trade, but rather benefited the fisheries by improving the commerce of fish produce exported all over Europe. In the seventeenth century and later, the shipping as well as the fisheries, successively, had developed considerably; and at present, according to the last census, from 70,000 to 90,000 persons, or 4½ per cent. of the whole population, are employed in the fisheries, and about 50,000 persons, or 2¾ per cent., in the shipping trade. In many districts, the building of boats for the fisheries is of some importance. In the boats there is a great variety of forms, according to the waters they have to cross and the different kinds of fishery for which they are intended. The visitors to the Exhibition will find a large collection of models of boats in the Norwegian department. As early as the ninth century, the history of Norway mentions the importance of the Vestfjord cod fisheries, describing the Lofoten islands as the principal station. There has never been any record of the non-appearance of codfish at this part of the coast in the season, the quantities varying from miles of shoals to lesser quantities. The herring fisheries were at one time of almost as much importance for the Norwegian commerce as the cod fisheries. At present the winter or spring herring fishery is of little importance, amounting to scarcely 30,000 barrels a year, while the summer or fat-herring fishery produces an average of 600,000 barrels of pickled herrings annually. The salmon, trout, lobster, mackerel, and sprat fisheries are of minor importance, the aggregate value being but 1,700,000 kroner, or £23,000 yearly, while the cod and herring fisheries yield the fishermen 21,500,000 kr., or £1,110,000 a year.

THE GREAT COD FISHERIES.

THE LOFOTEN COD FISHERY.—Lofoten is the name of a group of islands extending south-west from the main land, from 69° 38′ to 67° 25′, and forming with it the great Vestfjord.

The permanent population of these islands is scarcely more than 25,000, supported chiefly by fishing. We find, however, on some of the larger islands, very good and well kept meadows. Besides the dwellings of the permanent population, there are in every bay, which is in any degree protected from the ocean, a number of huts which the proprietors, who are frequently merchants and fishermen, have built, and let out to fishermen from other places during the season. These huts, which usually are arranged for one or two boats' crews, six to twelve persons, consist of only one room with deal berths along the wall, and another room for keeping the nets, cords and lines, barrels for the roe and oil, and the provisions and clothes of the fishermen. The codfish are taken in Lofoten in three ways, namely, with hand-lines, with long lines, and with gill-nets. It is generally the poorest fishermen who use hand-lines only. Their catch amounts on the average to 50 fish daily for each man; sometimes, however, they get from 100 to 120. For bait they use fresh or salt herrings; and when these are not to be had, pieces of codfish or its roe. A boat equipped for long-line fishing is from 36 to 40 ft. long, 9 to 10 ft. wide, and 3 ft. deep, has at least six sets or 24 lines, each with 210 hooks, 6 or 8 ft. distant, on fine snoods of hemp or cotton, 16 to 20 in. long. The bait is the same as in hand-line fishing. At the time prescribed by the officers in charge of the Fishing Stations, usually in the afternoon, and only at the places they appoint, the lines are set, with from 500 to 2400 hooks, according to the number of the crew and to local circumstances. If the fish rise from the bottom, the lines also are raised to the same height by means of glass floats. On the following morning the lines are taken up. If the fish are near the coast, and not much time is required for rowing out and back, the fishery with long-lines may take place during the day. The proceeds of this fishery are of course very variable. On the average it may be taken from 50 to 60 fish daily per set (Bak). The boats equipped for fishing with gill-nets have generally 30 to 35 nets on board. The length of the nets varies from 15 to 20 fathoms ; the depth between 25 and 60 meshes, measuring from 80 to 95, and sometimes 95 to 100 millimetres between the knots on each side. The nets are kept upright in the water by floats of hollow glass (an invention by Mr. Christopher Faye in Bergen), wood, or cork. A catch of between 400 and 500 cod is considered satisfactory. If the take exceeds 600 to 800 fish, the fishermen are obliged to leave part of the nets in the sea until the afternoon, as the boats can seldom hold a larger number of fish besides the nets and the crew. The catch of codfish for the years 1876–82, for Lofoten, in the season, i.e. from January to April or May, was an average, 26·3 millions fish. The number of fishermen, 26,309, with from 6500 to 6800 open boats.

THE OTHER LARGE COD FISHERIES.—While great shoals of cod come into the Vesttjord, others, in order to spawn, seek the banks on the outside of the coast from the 69th degree of latitude to the North Cape. Small shoals of cod with roe and milt appear up to Vardö. But this is generally of small importance in comparison with that of the so-called capelin fishery. At the end of February—sometimes earlier—the appearance of millions of gulls (Larus glaucus, Larus eburneus) and the blowing of a number of whales on the surface of the ocean in the vicinity of the North Cape, or frequently somewhat more to the east, announces that the small capelin (Mallotus villosus, Osmerus articus) the favourite food of the codfish, is approaching the coast, and the codfish follow in immense masses

Towards the end of May, the capelin usually retire to the ocean, accompanied by the masses of cod, which the fishermen pursue to a distance of some miles from the coast. But in the Varanger fjord they sometimes remain until June. The average catch for the years 1876 to 1880 is calculated at 15·3 millions of cod, on the coast of Finmarken; the number of fishermen being over 14,000 and of the open boats over 4000. From January or February to April or May, the cod fishery is also going on from open boats, and partly from decked vessels, along the coast of Romsdal, Söndmöre, and Nordmöre (between Cape Stat and Trondhjem). The catch of the season was on an average, for the years 1876–80, about 7·5 millions of cod, making a total for all the three cod fisheries mentioned above an average of 49·1 millions of cod in the *winter* and *spring* seasons. The catch of cod, ling, tusk, coalfish, and haddock, in the *summer* and *autumn* is of less importance, and so is the catch of cod in winter and spring at other stations than the above-mentioned parts of the coast. If all these fisheries are put together the amount of fish caught will be pretty large, as it yields an average *export* of dried and dry-salted fish of 75,000,000 yearly, which would answer to about 375,000 tons of live fish.

THE HERRING FISHERIES.

The annals of Norway mention that in the first half of the sixteenth century the fishery of *winter* herrings took place on a large scale in the neighbourhood of Bergen, while towards 1567 the fish did not visit these coasts. It is supposed that the herrings were again there in the seventeenth century; but it is known that from 1650 to 1654 there was no fishery. In all probability the fishery did not recommence before 1699 or 1700, and from this time it was carried on uninterruptedly until 1784, although with extremely variable results. In the year 1784 the herrings again deserted the coast, and did not reappear until 1808. From this year to 1870, the winter herrings have constantly visited the coast in great masses, yet a remarkable decrease was noted in the last named year. At present there are scarcely more than 30,000 barrels of spring herrings caught at the old stations. The shoals of herrings which selected the coasts south of Bergen for their spawning place, usually moved from south to north, from Skudesnæs fjord to Selbo fjord, both along the outside of the islands and among them. The shoals which had their spawning ground to the north of Bergen, moved on the contrary from the north and south from Bremanger to Fensjord; others touched somewhat later on the environs of Cape Stat and the Söndmöre coasts. The herring was caught by gill-net and sweep-nets, or large seines, a gill-net boat being furnished with from 20 to 40 or 60 nets of about 12 to 15 fathoms long and 100 to 120 meshes deep, the size of the meshes being 28 to 35 millimetres between the knots. With the large seines were 3 boats, and 20 to 25 men employed, the seines being 100 to 150 fathoms long and 20 to 30 fathoms deep, or less, that is, from 80 to 100 fathoms long, and 15 to 20 fathoms deep. Gear and boat would cost £400 or £500. The number of fishermen employed in the fishery was about 25,000 to 30,000, with 6000 open boats, and if the crews of transport vessels, working people, and coopers are counted, there would be at least 50,000 persons. The total catch for the season averaged 600,000 to 800,000 barrels. But in the last years the summer herring fisheries have become the most important, almost taking the place of the winter fishing. In July the *summer*-herrings are usually found somewhat more towards the north, in Søndfjord, Nordfjord, Romsdal, and afterwards in Nordmore in the Trondhjem fjord, in the Namsen fjord, also along the coast of the province of Nordland, and even up to Finmarken. The shoals of summer-herrings are very irregular; but no year is known in which some tracts of the coast mentioned have not been visited by larger or smaller shoals of them. The herring caught in August and September are preferred; not only is the flesh then still very fat but the lining fat is also firm and will keep well. Later in the autumn the lining fat decreases and is replaced by milt and roe. At the end of November this fishery usually ceases; but in several of the deeper fjords, such as the Trondhjem fjord, Namsen fjord, and Eidsfjord, in Vesteraalen, the herrings often remain till January. But at this period the herrings are very thin and dry, and are chiefly used as bait for cod-fishing. The gill-nets used for this fishery are usually from 15 to 50 fathoms long, 200 to 250 meshes deep, and the meshes 23 to 27 millimetres between the knots. Large seines or sweep-nets are also used to a considerable amount. There are no exact statistics of the catch; it has given annually an export of from 500,000 to 600,000 barrels of pickled herrings as an average for the years 1877–80, and has employed 35,000 or 40,000 fishermen.

Of other fisheries on the coast, of some importance to the population, there are the sprat, the mackerel, the salmon, and the lobster fisheries; these will, however, altogether not exceed 7 per cent. of the value of the Norwegian *coast-fisheries*, just mentioned. The fisheries for supplying the local fresh-fish markets of Norway are not yet subject to any statistical record.

The *deep-sea* fishery in the North Sea is still a trifling one as far as Norway is concerned, but the whale-fishery by steamers on the coast of Finmarken has become rather large of late years, employing in 1883 over 20 steamers, and yielding last year a catch of 386 whales.

Combined *fishing and hunting* expeditions are carried on by about 80 decked vessels in the Arctic Sea and on the coast of Spitzbergen ; the result last year was half a million of codfish, 6000 seals, 148 walruses, 49 polar bears, 260 reindeer, etc., amounting in value to £140,000. The *sealing*, or seal-hunting by steamers in the Arctic Sea, is another trade, that last year was carried on by 15 steamers of an average of 259 tons, and gave a result of 100,000 sealskins and 19,000 barrels of fat and oil.

Further particulars respecting the fish trade and commerce of the country will be found at the head of Class III., as statistical notes on the export of fish products from Norway.

PORTUGAL.

THE maritime portion of the continent of this kingdom is divided into three Departments, in all of which fishing is more or less carried on, but it is an industry which at the present time cannot be considered as in a very flourishing condition.

There does not now exist in Portugal what is known as deep-sea fishing, that is, fishing practised beyond the maritime limits, and that commonly called *coast* fishing tends to deceive, as it is known that this fishery has no limits determined by the extent of the shore, and when carried on at some distance from land it is termed deep-sea fishing. We have also to deal with fishing in rivers up to the point where they join the salt waters.

Both fresh and salt water fishing are divided into two large groups according to the means employed in the capture, viz., net-fishing and fishing with lines. The first-named, undoubtedly the most important, is again sub-divided into two classes, fishing with fixed nets and trawling; either carried on from land or at sea within walled enclosures.

Besides the means adopted in catching the moving species, there exists what may constitute a third group, which is, however, insignificant.

At this point we will proceed to a rapid review of the manner in which the fishing industry is carried on in the three Departments and the sub-districts.

Department of the North.

This comprises the shore from the river Minho to the left bank of the Mondego. It consists of five districts, viz.; 1. Caminha. 2. Vianna de Castello. 3. Porto. 4. Figueira. 5. Aveiro.

1. *Caminha.* In this district, which comprises the townships of Caminha, Villa Nova de Cerveira, Valença, and Moncao, the industry is divided into two branches, coast fishing and river fishing. On the coast are caught whiting and other coarse fish, sturgeon, and sardines; in the rivers, lampreys, salmon and shad. The appliances used in coast fishing are the nets called *Volanta* (of gauze and with narrow meshes), *Zangirelho*, *Vallo*, and *Sardinheira* (for sardines), for river fishing, those designated *Lampreeira* (for catching Lampreys), *Tresmalho* (Trammel), and *Algerife.* Lines too are made use of, and hooks, on a smaller scale, and another net, similar to the *Vallo*, for catching young sturgeon and smaller fish. With the exception of a small section of the town of Caminha, the people who carry on this industry are not fishermen properly so-called, but artizans of various kinds and labourers, and only a small portion of the inhabitants keep to fishing to the exclusion of all other pursuits. The season for fishing in the Minho is restricted to the months of January to June, but on the coasts is carried on whenever circumstances are favourable. The vessels used for fishing purposes at Caminha may be stated approximately at one hundred and twelve, twenty of which are employed both on the coast and river, and the remainder on the river exclusively while the season lasts. In the three remaining townships the fishing boats are about equal in number to those at Caminha.

2. *Vianna de Castello.* This district consists of the town-

ships of Vianna and Ponte de Lima. In this district likewise the fishing industry is divided into two branches, coast fishing and river fishing. On the coast are taken whiting and coarse fish, also sardines, and in the river lampreys and lobsters. The mode of capture is by nets (names not given), but other apparatus are used for taking lampreys. The take of this district is all consumed locally. The embarkations number one hundred and six, forty being small vessels for river fishing, forty-four for sardine catching, and twenty-two larger ones for catching whiting. The number of men employed may be stated at about five hundred. The industry is carried on all the year round, the sardine appearing in greatest quantities from May to December, while river fishing takes up the months of February, March, and April.

3. *Porto.* This district comprises the townships of Porto, Villa do Conde, Villa Nova de Gaya, and Amarante. Fishery on the coast (in deep water) consists of whiting, congers, *safio*, and other species; on the coast, sardines, *fanece*, soles, and smaller fish. In the river, sturgeon, shad (*savel*), *savella* (small shad), lampreys and plaice, are caught.

The apparatus for deep-water fishing consists of nets called *saramonas*, *robaleiras* (for catching sturgeon), *vargas-chinchas* and *chinchorros*: the three last being employed in river fishing, in addition to the nets named *lampreeiras* and *feiticeiras*. There are 800 vessels employed in this district, 8 following deep-sea fishing from Valbom, 3 from Fureda, 1 from Avintes, 1 from Campanha; there are also 9 boats from Foz, 30 others from Matorinhos, 24 from Leço de Palmeira, 16 from Loire, 36 from Villa de Conde, 470 from Povoa de Varzim. In coast and river fishing 200 vessels are employed, viz., 180 from Valbom and 20 from Foz. The number of the crews amount to about 3,800 or 4,000 souls. These men do not ply their calling in Spanish waters.

Deep-sea fishing is carried on all through the year, that for sturgeon in winter; sardines, *fanece*, soles and smaller fish are caught on the coast in summer time, lampreys are taken in January and February, shad in February and March, *savelha* from May to July, and plaice at all times.

Delegation of Povoa de Varzim. At this place fishermen use for all kinds of fish, with the exception of sardines, fishing lines and hooks called *espineis* or *espinheis.* Deep-sea fishing, that is fishing for congers and *safio* (a species of conger) is carried on by line, and that on the coast for *fanece* with a line carrying six hooks. The nets used are those named *meios*, for all such fish as whiting, &c., and *rascas* for turbot skate, and soles; the net called *pesceda* for roach and similar kinds: lastly, a special net for sardines. There are in this delegation 470 vessels, viz., 94 pinnaces (*lanchas*), 42 boats (*bateis*), and 344 *catraias*, which are employed at fishing in one way or another, according to the fish required and the season of the year. The pinnaces are employed nearly all the year in catching whiting; their complement is 20 men, but in the winter those employed in catching sardines either divide their crew amongst these or the smaller boats (*bateis*). The *lanchas* have a crew of from 12 to 17 men, and the *bateis* about 8 or 9. These latter are employed in catching sardines, and with the nets called *rascas* in catching turbot, skate, and soles. The *catraias* are only used when the weather is quite calm, and fish with the hooks called *espineis.* Their crew numbers 8 or 10, and have lines and the nets called *meios* worked by 4 or 5 men. Besides this, the same people are employed in catching sardines. The approximate number of men engaged in the fishery industry of this delegation is about 2,630.

4. *Aveiro.*—This district comprises the townships of Aveiro, Feira, Ovar, Angeja, Llhoos, Vegas, Mira, and Verga.

There is no deep-sea fishing here. On the coast the industry is plied, and on the rivers and their confluents, all kinds of shell-fish being taken. The methods of capture are drag-nets on the coast, and on the rivers drag-nets also, but of smaller dimensions. Besides this, the shell-fish are taken with a sort of iron rake called *ancinha*. There are about forty vessels employed in the trade, with twenty or twenty-five men. The crew of the vessels employed in the rivers and confluents varies, according to the nets used, from two to eight men; the same number man the boats which are engaged in catching shell-fish. Fishing in this district is carried on all the year round. The fish taken are shad, *sabogas*, *tainhas*, sturgeon, *negrães*, lampreys, seals, &c.

5. *Figuiera.*—This district comprises the townships of Figueira and Lavas. The principal branch of industry in this district is the sardine fishery. On the sea whiting and other large fish are caught. The mode of capturing sardines is with short drag-nets, and other nets (*aimalhar*) are used on the sea, special nets toó are employed on the rivers.

The whiting fishery is carried on solely by vessels with trawl nets, which remain in the sea for a day or more. The nets are provided with proper buoys and marks. Conger fishing is carried on with hooks and lines, and other appliances suitable for catching a variety of fish are also made use of. In the rivers, fishing is exercised by means of drag-nets (*tresmalhos* and *atalhos*), besides which are employed the *botiraes* already alluded to. The fish gathered in are lampreys, shad, sturgeon, &c. Flat-bottomed boats for sardine fishing, are used, with drag-nets, the boats being manned by thirty men. Flat-bottomed boats too are used for river fishing, and keeled vessels manned by twenty men for whiting. The number of individuals employed cannot be determined, but may be stated as some thousands.

The season for fishing is the whole year, with the exception of sardine drag-net fishing, which lasts from May to the end of January, and the other sardine fishery from October to the end of February.

Central Department.

This comprises the shore from the left bank of the Mindego to Cape St. Vincent, and is divided into three districts, viz.: 1. Alcoboça (Sollartinho); 2. Lisbon; 3. Setubal.

1. *Alcoboca.*—(sea-port S. Martinho). This district includes the townships of Alcoboço and Obidos, and has two ports, where fishing is carried on, viz., S. Martinho (Foz do Arelho) and Praia de Nazareth (Costa de Vieira).

S. Martinho has only about fourteen or fifteen fishermen by profession, the larger portion being sailors, who when they have no other work follow fishing, to occupy their time, in boats of their own.

The fish caught here are eels (*safio*), in from 12 to 14 fathoms of water, outside the bar, and for a mile N. and S. Lobster fishing is carried on outside the bar by means of traps in 8 or 10 fathoms of water. Shell fish are also taken outside the bar with proper utensils, and also on the river, but this latter fishery is unimportant.

There are occasions when quantities of both large and small fish of all kinds come within the limits of the port, drag-nets are employed in catching these, besides small nets called *tralhas*, and the tackle called *espinheis*. The summer months is the time when the industry is most active at this station. The vessels employed are small boats and canoes, of from ten to twenty tons, manned by one or two hands. The market is supplied with fish coming directly from Nazareth.

Lagoa de Foz do Arelho.—Different qualities of fish are captured here, and the utensils adopted are those called *aigerifa*, which require four or five persons to work them. The vessels are small boats with flat bottoms. The individuals who carry on fishing are not exclusively fishermen, but are engaged during the larger portion of the year in agriculture, and only follow the former calling in winter. Every year four or five boats are enrolled, having eight or ten men.

Praia da Nazareth.—This is the most important point in the district. The methods of capture on this coast are drag-nets and fixed engines for small fish, and hooks for the larger species in deep waters. The total fishing products at this port of late years has amounted to from sixty to seventy million reis (this relates to the year 1878). Thirty vessels are engaged here of various sizes, twenty-four being employed with drag-nets and fixed engines, the remainder follow sea-fishing. The number of persons employed is less than 300. There is no restriction in the seasons except for fixed engines, which can only be used from May to August; other fishing lasts all through the year.

Vieira.—The fishing industry at this port is confined to sardine catching with drag-nets. There are five barques and sixteen hands, in addition to a company of from forty to five hundred day labourers. The season lasts from July to the end of October.

2. *Lisbon.*—This district comprises the townships of Lisbon, Lerminha, Sobral, Peniche, Ericeira, Cintra, Cascaes, Ociras, Betem, Olivaes, Villa Franca, Arambrija, Atcochete, Aldegallega, Barrein, Seisal, and Almeda.

Peniche.—Branches of industry, coast and deep-sea fishing. Fish taken are sardines, *chicom*, whiting, *safio*, *cherne* and others. Approximate value 37,000 milreis. Modes of capture, *armações*, nets called *saccadas*, *sardinheiras*, also hooks and lines. There are twelve large vessels carrying the *armações*, sixty-two smaller ones auxiliary to them, sixty small ones with the *sardinheiras*, thirty-eight large boats for catching *chicom* with the *saccadas*, and for larger fish ninety others are enrolled, with crews amounting to 1550 men, besides thirty occasional hands. The season for sardine-catching with *armações* takes place from January to August, and with *sardinheiras* from August to December. Deep sea-fishing goes on all through the year.

Ericeira.—Coast fishing only carried on here, the fish caught are whiting and sardines; lobsters also are taken. Nets are used for whiting and sardines; the lobster is taken with a trap shaped like a sack and placed at the bottom of the sea. There are seven vessels of large size for the nets employed in catching whiting, with crews of ten to eighteen; also thirty smaller ones employed in hook-fishing for sardines, and rod-fishing for whiting entering the sea from the river's mouth, and such as can be carried on close to the port. These have crews of from four to eight persons. Besides these there are very small boats designated *focinhos de porco* (pig's noses), of which there are twenty, managed by two and sometimes by one person only. These are engaged in lobster catching, also try for sardines, and sometimes use hooks. This port possesses a hundred and seventy fishermen. The season for whiting (with large boats) is from July to October inclusive, and at other times whenever the weather and water permit.

Lisbon.—River and coast fishing. There are, more or less, six boats (*canoas*) of small dimensions employed in line fishing on the river, and in summer, from June to

August, proceed to Cascaes, Cabo Rezo, and Arta de Caperaia. The number of fishermen is twenty or thirty.

Belem.—About six boats, more or less, with the same number for crew, and under the same conditions as at Lisbon.

Bom Successo.—Three or four boats and fifteen men.

Paço d'Arcos.—Here are five or six boats employing twenty to thirty men. The tackles used are hooks and lines. The season is from June to August, and the calling is plied both within and beyond the promontories at a distance of three miles, and on rocky bottoms at a depth of from 30 to 40 fathoms, fishing is carried up to Cabo de Roca to a depth of 500 fathoms, also on rocky bottoms.

Cascaes.—The branches of industry are fishing with various lines and tackle, some for whiting and other varieties of fish, others for sardines. There are a dozen boats, manned by about thirty hands, which fish under the same conditions as at Paço d'Arcos. Apparatus, *armações.* In the months from March to September there are placed in the bay four or five of these, which employ about twenty small boats, with 100 or 150 fishermen of different ranks. The depth of water is 11 or 12 fathoms, the size of mesh in the nets is $\frac{1}{2}$, 1, 3, and 6 inches (*polgedas*).

Costa de Caparica.—The branch of the industry here is fishing with drag nets, called *Artes.* There are on this shore twenty-four boats (*saveiros*), manned by 500 or 600 hands. Fishing is conducted at all seasons of the year, the nets being launched in from 6 to 10 fathoms of water, and have meshes of from 1¼ to 6 inches.

Trafaria.—Hook and line fishing, and in winter nets are employed for sardines, also casting nets, mesh $\frac{1}{2}$, 1, and 1¼ inches. There are fourteen or sixteen boats (*saveiros*) and twenty canoas and small boats, with about 400 or 500 people.

Seisal.—Branches of industry, catching sardines and other fish. These are captured with drag-nets (*tantarenhas*), and in the case of sardines with trawling nets. There are four or five smacks (*moletas*), fifteen to twenty boats for the drag-nets, and over thirty employed in sardine fishing ; the number of men being from three to four hundred. Outside the harbour the smacks and boats often trawl twelve miles to the south-east of Cabo de Roca to the coast of Capisson, at a depth of six fathoms ; the meshes used are ¾, 1, 1¼, and 3 polegadas. The smacks fish in summer and in winter too when weather permits, and also enter the river. In winter the fishery is principally confined to netting sardines within the roadsteads.

Barreiro—Net fishing. Vessels employed, sixteen to twenty smacks and boats, and two or three trawlers. These fish all the year round on the same conditions as at Seisal. Three hundred men are employed.

Extra hands (adventicios) at the port of Lisbon.—In the months from December to March there come from the various ports of Algarve vessels for the purpose of catching whiting, bream, and roach. The methods of capture are nets and lines, the depth being from 200 to 300 fathoms. There also come from Setubal, during the months of April and May, certain strangers who ply the whiting fishery with hook and line. From the northern ports, such as Aveiro, Poroa, Ericeira there arrive, between October and February, some boats of those localities to catch sardines. In the Tagus they try for shad.

Third District—Setubal.

This comprises the townships of Setubal, Cezimbra, Alcacer do Sol, S. Thiago de Cacem and Sines. Branches of industry, on the coast, gear (*armações*) for sardines and fish in general, *artes* and *chinchas;* in the ocean trawling nets, with smacks, &c., also lines. On the river *chinchorros* (small trawling nets), *tresmalhas, cassoara* (net for sea lamprey) traps, and wheel nets are used. In estimating the relative importance of the fisheries the first place must be assigned to that with the *armação*, which is valued at 6000 milreis, then comes that with the *arte*, at 1,500 milreis. The fishery with hooks is likewise important, and also that for shad. In the year 1877, 154 vessels were enrolled, viz., 101 from Setubal, with crews amounting to 459 hands, and 53 from Cezimbra with 201 hands. In 1878 there were 125 vessels with crews of 579, viz., 17 *cahiques*, 51 *canoas*, 8 *bateis*, 13 *botas*, 17 *barcas*, 1 *lancha* and 18 *armações*. The crew of the last named varies daily, extra hands being taken on when wanted. There are besides 19 *armações* on the coast of Cezimbra and from Arrabida, 9 from the coast of Galé, 3 from the coast near the bay of Sevias, and 1 from the south-east of Odemira. There arrive, too, many Spanish feluccas for the purpose of buying sardines. The decline of the fishery industry is attributed to the smallness of the meshes in the nets used.

Cezimbra.—Branches of industry, fishing for sardines, and large fish, such as whiting, &c. The mode of capture is by the *armações*, trawl-nets, and hook and line. There are also rod fishing and drag net fishing, but these latter are not important. In the nineteen *armações* hailing from this coast, from the neighbourhood of Arrabida to Cabo d'Espichel, there are employed 114 vessels manned by 700 people (a few more or less), each *armação* ordinarily employs six embarcations. To deep-sea fishing there go out forty-one vessels manned by about 500 souls. The *artes* employ the same people as those mentioned above, but only keep them for a small portion of the year.

Sires.—The branches of fishing here are those for sardines and mackerel (*sarda ou cavalha*). They are caught with implements called *armações á Valencianna,* of which there are three, but they are not all used every year. There are in the bay two *chinchorros,* and on the coast of Molida three large trawl nets. There are thirty small vessels manned by thirty hands, no canoes nor *caloes.* Net and line fishing is carried on throughout the year: the *armaçoes* work from March to September, the mackerel being caught during the summer. The nets are launched close to the shore.

Department of the South.

This includes the shore from Cape St. Vincent to the river Guadiana, and is divided into five districts, viz.: 1. Lagos; 2. Villo Nova de Portimão; 3. Faro and Olhão; 4. Tavira; 5. Villa Real de Santo Antonio.

1 *Lagos.*—This district comprises the townships of Lagos and Silva. The gear used consist of *artes de arrastar,* and *armações a Valencianna* for tunny, *corvina* and *sarrajão.* The fish caught are sardines, tunny, *corvina,* and *sarrajão.* Deep-sea fishing is very limited. Sardine fishing is carried on all through the year, but the proper time is when the shoals arrive, viz., from the beginning of October to the end of December. Tunny fishery (*de direito*) is from the beginning of April to the 20th of June, the other (*pesca de revez*) from the latter date to the end of August. The decline of the industry is attributed here to the want of proper fishing, and also to the lack of men, from the tendency these have to engage in the Spanish fisheries. In 1876 there were enrolled —1 *armação* with 53 hands, 2 *caloes* with 8, 3 *cahiques* with 15, 10 *artes* with 77, and 8 *lanchas* with 22 hands. In 1877 the numbers were 1 *armação* with 27 hands, 1 *calão* with 4,

2 *cahiques* with 8, 10 *artes* with 100, and 12 *lanchas* with 30 hands.

2. *Villa Nova de Portimão.*—This comprises the townships of Portimão and Albufeira. The maritime authorities state that the fishing industry shows a gradual increase on the coast of this province. The branches of industry are net fishing for tunny, *corvina*, *sarrajão*, and sardines: deep-sea fishing for whiting, seabream, *chicharro*, *dentao*, and mackerel: river fishing for small fish: and oyster dredging. The gear used in the capture are *armações* for tunny, *corvina*, *sarrajão*, and sardines: *artes* for sardines and carapão: *gorazeiras*; barquiera; lines for seabream, &c.; and traps for some other kinds of fish. Lastly, small drag-nets for river fishing, and the *rastro* are in use. Light boats are attached to the only armação used in this district, and the crews number 174 persons. In the fishery with *artes*, 17 *calaes* and 340 men are engaged, consisting for the most part of men not enrolled (*adventicios*). For the deep-sea and coast fisheries there are 77 barcas, 3 *botes* and *lanchas*, and 3 small *cahiques*, their crews numbering 308. When the sardines appear in shoals the number of extra hands is much less than that cited above. The season for tunny, *corvina* and *sarrajão* is the months of May, June, July, August and September. The sardine is caught all the year round, but with most profit in August and September; whiting in January, February, and March; the *dentão* and seabream in June, July, and August; the *chicharro* in January. Trap fishing is in force all the year round; oyster dredging from December to April; net fishing in the river throughout the year.

3. *Faro.*—This district comprises the townships of Faro and Olhão. The value of fishery products exported to Spain and cleared from Faro was, in 1875, 209,882 milreis; in

1876, 139,797 milreis; in 1877, 153,840 milreis. The branches of industry are tunny fishing with *armações*, sardine fishing with *artes*, line fishing and dredging for oysters. The tunny are captured by being driven into enclosures called *almadrabas*, sardines are caught with drag-nets, oysters with the *rastro*, other fish with lines, &c. River fishing is carried on with the *tresmalho* and various other nets. There exists in this district an establishment for the preparation of oysters, and which exports them to Paris in boxes of 100 and 200 tins. Seven or eight boats, manned by 60 or 70 people, are employed in oyster dredging. The vessels on the list are—1 *cahique*, 11 *barcas*, 40 *lanchas*, 1 *saveiro*, 12 *botes*, and 2 *calões*. There are 4 *artes* for sardine catching, 3 *armações* for tunny. The number of persons employed is 459.

Olhão, delegation of Faro. The people of this district is beyond doubt the most industrious of the coast of Algarve, applying themselves throughout the year to one or other branch of the industry. The branches here are *artes* for sardines, *armações* for tunny and *corvina ;* deep-sea fishing, which is divided into groups for the several kinds of fish, is carried on at various places, such as Charnal, Fourdinhas, &c.

The catching of mackerel (*avalha* and *sarda*) and the *sarrajão* is carried on at Larache, and that of Janeiro to the neighbourhood of the port of Lisbon. There are besides fisheries of various kinds on the coasts and rivers, viz., that with the *tresmalho*, *tapa esteiros*, *redinha choqueiroz*, *marisqueiros*, and several other sorts of fishing implements.

The most important of these industries is sardine fishing, then that for tunny, afterwards that for *coiro*, whiting, *sarrajão* and mackerel, shell-fish, and lastly that for miscellaneous sorts. The methods of capture are *armações* or *almadrabas*, each of the forme employing eleven embarcations for working the gear and the transport of fish, with structures for the storage of material and the shelter of people. In this district there exists only one, an *armação de revez.*

The *artes* for sardines have each a *calão* and a batel and small boats (*lanchas*) for the transport of fish. The gear used are known by the names of *espineis, tullas,* gorazeiras, palanques, *arqueiras.* The *linhas* are small nets used for the implements known as *tresmalhos* and *tapa esteiros.* Besides these many other appliances are in use. Oysters too are caught in this neighbourhood and are exported.

The destination of the fish sold is in the case of tunny, Olhão Tavira, and Villa Real de Sto. Antonio, also Spain (after being prepared and salted here), Oran and Brazil.

The sardine is sold to Spanish vessels trading at this port, and also goes to some of the ports at the north of the kingdom as well as to some of the Mediterranean ports, notably Oran; much, too, is consumed in the provinces and at Alemtejo. When the supply is abundant they are salted and compressed. The *couro* is also prepared here by drying: the commerce in this, together with the *leitão,* are important, as the value of the exports amount to a considerable sum. The *sarrajão* is sold on the spot to Spaniards. Mackerel are prepared on the vessels, and nearly all go to Lisbon. Whiting are generally sold for Spain, the fishermen coming from Cadiz and carrying them away in Spanish vessels. Other fish are consumed in the provinces and at Alemtejo. Shell-fish are mostly exported to Spain. Oysters go to Gibraltar and also to Oran.

The number of vessels engaged in the industry cannot be accurately stated, since the same boats are employed in more branches than one. The total number of vessels enrolled in 1877, was 106 at Olhão, 49 at Ferrata, with *artes* belonging to Olhão. In the *espinel* fisheries there are employed 15 *lanchas*, and *canoas* in the *larache*, 20 *cahiques*, 12 *canoas* and 1 *lancha* from Olhão, with 8 *cahiques* and 6 canoas from Ferrata. The number of vessels in the fisheries for whiting, varies according to the greater or less abundance of the fish; the vessels used being *lanchas* and *canoas* only. The *Janeiro* fishery, which lasts from January to Easter, occupies 14 *cahiques* from Olhão, and 10 from Ferrati: it is pursued all along the Portuguese coast, the produce being carried for sale to Lisbon, Cezimbra and Setubal. The population enrolled for all these vessels numbers 923, made up of 628 from Olhão, and 295 from Ferrata. The season for tunny *de direito* is from the end of April to June, that for *de revez* from the end of June to the end of August. The sardine is caught all the year, but with most profit from August to January.

Coiro are caught from April to October, and whiting all the year with the gear known as *tallas*, and with *linhas* from October to March. The Larache fishing for the *sarrajão* is from April to the end of June, and that for mackerel from May to September. The Janeiro fishing for whiting, roach, swordfish, &c., lasts from the end of December to Easter; shell-fish are taken from September to April, the remaining species all the year round.

4. *Tavira.*—This district consists of the township of Tavira. The branches of the industry are net-fishing and fishing with hooks. The gear used are *armaçã* or *alma drabas*, for tunny, drag-nets for sardines, and hand nets for smaller fish. Hooks and lines are also used. In the rivers and lakes, lines are used, together with hand nets and the *candeio*. The most important of these methods are the *armações* and the *artes de chovega*. The vessels number 7 employed in the transport of fish (*andainas*), 13 *artes de chovega*, 15 *barcas*, employed like the first named, 7 *canoas*,

2 *lanchas*, 19 *botes*, and 4 *armações*. There are on the average 330 persons employed in net fishing and on the smaller vessels, and 300 on the *armações*, but on exceptional occasions many persons from inland come to help the fisheries. These latter proceed with the fishing *de direito* from April to June, and with that *de revèz* from June to the beginning of August. The other appliances work during the year at the most suitable stations. The season for sardines is from October to December, *vezago* and whiting are taken throughout the year, the swordfish in December, January, and February, the roach and *dentão* in August and September. The produce of this fishery is sold in Portugal and Spain.

5. *Villa Real de Sto. Antonio.* This district comprises the townships of Villa Real, Alcoitim, and Martola. The branches are net fishing and line fishing. The means of capture are *barcas* or *chovegas* (arte) galcãs or circular net. the nets called *erada*, *solheira*, *tresmalho*, and *tapa esteiros*, the *palangre* and lines. The *chovega* or *arte* and the *galeão* are used for sardines, and lines for the various qualities of fish, and *tapa esteiro* for the tainha. The sardine fishery is the most important in this district; in the month of October, 1877, there were sold in Villa Real, 27,000 milreis' worth of this fish. The vessels number 1 *galeão* (now 2), 27 *borcas* (artes), 56 coasters for carrying fish, 4 *lavadas*, 6 *solheiras*, and 2 *tresmalhas*. There are about 1000 persons employed regularly, and besides these some 200 outsiders, principally women and children, who work as extra hands. The total number of seamen enrolled is 1386, but some of these are employed in navigation. The time for catching *corvina* is from March to the end of June, and that for sardines from September to January, when they most abound. The fourth and fifth districts of this Department have been worked

since the convention with Spain, by Spanish vessels, of which some 20 or more come here to fish during the sardine season which is not to the interest of our fishermen.

NOTE.—At Lagos, Portimão, Foz, Olhão, Tovira and Villa Real, there are societies for the benefit of fishermen, these were formerly of great help to them, but now, owing to abuses, the societies are in a state of decay and have little importance.

LISBON, 11 *April*, 1883.

SPAIN.

THERE do not exist in Spain any deep-sea fisheries properly so called, involving the despatch of large fleets at certain periods of the year, and to certain points either at sea or on the coasts of savage or uninhabited lands, as it is known was the case when this country was possessed, or shared with other nations, the dominion of the seas. Since those palmy days, when, as in the reign of Philip II., two hundred vessels, with no less than 6000 sailors, left the Cantabrian shore for the cod fisheries of Newfoundland, these expeditions have been constantly declining, and have ceased altogether. However, though in a different way, and resting on ancient rights of dominion, deep-sea fishery is coming to life again in this country, as is evidenced by the Canary Islands, on the West Coast of Africa. There a company has been formed, called the "Canario Africana," which is working the principal shoals on an extensive scale, and establishing factories on the island of Graciosa in that archipelago. With this exception, and without taking into account our important colonial fisheries, of which, owing to pressure of time in preparing this catalogue, it has not been possible to procure data, the fisheries as carried on in Spain are limited to what is technically known as coast fishing. Nevertheless it should be observed that, on the ocean coasts, this description of fishery, both in respect of the number and tonnage of the craft, and the distance they go from the shore at certain points, is, in a way, as important as deep-sea fishing is in certain other maritime countries. In the Gulf of Gascony there are steamers that go out about fifty or sixty miles off the coast to compete with the French in working certain shoals, using a fishing instrument called "bou" by the Spaniards and "chalut" by the French; both showing but little wisdom in thus using this trawling apparatus, which will end by destroying the fish which are usually to be found on the shores of this gulf in both countries. On the Cantabrian coast sailing boats and row boats go out to the same distance, although it is impossible to define the existence of shoals properly speaking, because, what with the species of fish native to the shores, and the migratory fish, the whole coast may be said to yield a large produce, but not to the same degree as the adjoining coast at the Punta la Estaca, where, owing to the numerous rivulets and streams, and the large quantity of vegetable and animal matter which they bring with them, attracting various species of fish, the entire coast of Galicia may be described as one continuous shoal, of which these channels are the spawning grounds and principal centres. At the mouth of the Miño ends the first fishery division of the North and North West, which covers an extent of 1567 kilometres; and at the mouth of the Guadiana begins the second zone or division, which terminates at the Campo de Gibraltar, extending over 204 kilometres. This second zone, though smaller, is not inferior in its yield of fish, as is proved by the fact that an important establishment (in the island of Christina) has sprung up in a few years. There also, rivers and streams, flowing through fertile regions, provide abundant nourishment for the fish, which breed and migrate; and there likewise some steamers trawl with the tackle known as "bou" up to the African coast competing with the sailing craft in the shallow waters of this region, which is the entrance to the Mediterranean. All the sea coast, between the Campo de Gibraltar and the

French coast, extending over 1,149 kilomètres, forms the third zone, the poorest in fish produce, although nature points to the contrary, as in every respect this sea possesses greater advantages for the breeding of fish than the European or Atlantic Ocean. The explanation of this enigma is already familiar to the more important nations which share these waters; it is undoubtedly the absurd manner in which these fisheries are worked, or, rather, overworked; and although this may not perhaps be the proper place to do so, we cannot resist availing ourselves of the opportunity of pointing out to the various nations interested, the expediency of convening a congress to discuss this matter, which it will soon be impossible to deal with efficaciously, as all maritime nations are now sadly misusing the lavish natural gifts of the ocean to the various countries along its shores. The Government aid to the fishing industry is limited to encouraging initiative, by publishing the works of those who distinguish themselves in foreign countries, granting honorary rewards to those who in any way contribute towards proficiency in this line, creating a model establishment for the propagation of oysters and for pisciculture, for which the State provides accommodation gratuitously, and relieving fishermen from taxes in the exercise of their calling. There are some co-operative societies of fishermen. The fishery products on the coast of Spain for the year 1882 are estimated at 79,540,165 kilogrammes, the number of men employed was 59,974, and of boats 14,202, with a tonnage of 51,397. There are fifty private establishments, which produced in the same year 7,591,198 kilos. and employed 1,430 men, and 297 boats, with a tonnage of 2,100. There are forty-three other establishments for the cultivation of oysters and other shellfish and for pisciculture; but as they are in a primitive state, the produce is limited. There are 535 establishments for salting and preserving, which produced this year 26,370,612 kilogrammes of fish, and employed 12,313 hands,—men, women and children.

EXPORTS FOR 1882.—Fresh fish, 533,665 kilos, of which 106,733 for Algeria, France, and Portugal. Salted, 545,031 kilos, representing 218,011 pesetas, for Algeria, Germany, France, England, Italy, Cuba, and the River Plate. Cured fish, 63,918 kilos, representing 51,134 pesetas, for Portugal, Brazil, and the River Plate. Salted and pressed sardines, 3,300,064 kilos, representing 1,650,034 pesetas, for Germany, Algeria, France, England, Italy, Portugal, Cuba, Puerto Rico, Brazil, Columbia, the United States, Mexico, Peru, Uruguay, Venezuela, the Philippine Islands, and British Possessions in China. Shell fish, 167,653 kilos, value 50,296 pesetas, for Algeria, France, Portugal, and River Plate. The most important export is that of preserved fish, but as in the Customs Returns it is classed with other preserved alimentary products, it is not possible to furnish reliable data in this respect.

TABLE *showing the weight and value of fish exported from Spain during the year* 1882, *with the countries of destination.*

FRESH FISH.

Country to which sent.	Quantity.	Value.
	Kilogrammes.	Pesetas.
Algeria	1,600	320
France	209,310	41,860
Portugal	322,755	64,551
Total	533,665	106,733

TABLE *showing the weight and value of fish exported from Spain during the year* 1882, *with the countries of destination.*

PICKLED FISH.

Country to which sent.	Quantity.	Value.
	Kilogrammes.	Pesetas.
Algeria	20,260	8,104
Argentine Confederation	506	202
Cuba	3,353	1,341
England	96,800	38,720
France	8,481	3,392
Germany	420	168
Total	545,031	218,011

CURED FISH.

Country to which sent.	Quantity.	Value.
	Kilogrammes.	Pesetas.
Argentine Confederation	5,372	4,217
Brazil	462	370
Portugal	58,084	46,467
Total	63,918	51,134

SARDINES, SALTED AND PRESSED.

Country to which sent.	Quantity.	Value.
	Kilogrammes.	Pesetas.
Algeria	182,062	91,031
Argentine Confederation	3,510	1,756
Brazil	7,014	3,507
British Possessions in Asia ..	1,080	540
Colombia	106	53
Cuba	258,172	129,086
England	73,750	36,875
France	2,372,194	1,186,097
Germany	3,745	1,873
Italy	308,420	154,210
Mexico	1,697	849
Peru	18	9
Philippine Islands	1,717	859
Porto Rico	21,511	10,755
Portugal	44,293	22,147
United States	516	258
Uruguay	18,050	9,025
Venezuela	2,209	1,104
Total	3,300,064	1,650,034

TABLE *showing the weight and value of fish exported from Spain during the year* 1882, *with the countries of destination.*

SHELL FISH.

Country to which sent.	Quantity.	Value.
	Kilogrammes.	Pesetas.
Algeria	5,100	1,530
Argentine Confederation	115	35
France	162,173	48,651
Portugal	265	80
Total	167,653	50,296

SWEDEN.

OWING to the fact that Sweden, which is almost entirely surrounded by water (its coast-line is, 2,500 kilom.), has a great many rivers and streams, and next to Finland, the greatest number of lakes of any country in Europe, (one-twelfth of the area of Sweden consists of water)—the very nature of the country renders it peculiarly adapted to fish-culture ; and hence it follows that its fishery grounds ought to be one of the chief sources of the trade and industry of Sweden. The waters of the coast differ considerably from one another, as well as from the waters of the lakes, a circumstance which causes varieties in the fish fauna. The number of known species of fish in Sweden is at present about 170, of which, however, only about 50 are commonly caught for use. The most important fisheries are :—

A. *The Herring and Sprat Fisheries of the Baltic and the West Coast.* These, no doubt the most important fisheries, are carried on from the inmost part of the Gulf of Bothnia as far as the northern part of the province of Bohus. The nets used by the fishermen are standing nets (*sältgarn*), seines (*vadar*), and driftnets (*drifgarn*). The boats used in the Baltic are mostly open, and have a crew of two to three men ; on the west coast the boats used in drift-fishing are decked, and have from three to five men, seine fishing requires at least from ten to fifteen men for each seine. On the western and southern coasts of the country the herring fishery is generally carried on by a population living together in large fishing villages, and obtaining their subsistence solely from the fishery. But along the coasts of the inner Baltic from Kalmar to Haparanda, as well as the coast of the island of Gotland, the herring fishery is carried on partly by people who live in the interior and only visit the archipelagoes during the fishing season, and partly by fishermen from the various islands. The Baltic herring (*strömming*), a smaller variety of *Clupea harengus*, L., is sold either fresh in towns along the coast, or else salted in barrels. The barreled article is generally sold in Sweden—salted herring being the daily food of the Swedish peasant; but of late years it has also been exported to Germany. Herrings (*Clupea harengus*) and sprats (*Clupia sprattus*) are also caught, especially of late years, during the autumn and winter months, in the Skager-Rack, on the coast of the province of Bohus. The herrings are partly sold fresh and partly salted in barrels or or smoked. The sprats likewise are partly sold fresh, and partly pickled or spiced, while some are prepared as "anchovies," and sold under that name, although of course they are a different kind of fish from the true anchovy. Considerable quantities of these have been exported during the last few years. The yearly revenue of the herring and sprat fisheries of the whole country may be estimated in round numbers at 3,865,000 Swedish crowns, of which sum 2,650,000 is the revenue of the herring fishery in the Baltic and the Sound.

B. *The Coast and Sea Fisheries*, (*with the exception of the Herring, Sprat, Salmon and Eel Fisheries*).—Near the west coast and in the Baltic Sea the fishery is carried on in small vessels, but on the banks in the Skager-Rack and off the west coast of Skagen and Norway in larger vessels, called *bank-smacks*, which have a crew of twelve or fourteen men. The tackle used for the bank-fishery is the "Stor-backa," a long line that is laid out on the banks, and often laid at a depth of from 100 to 200 fathoms. As a bait either mussels or bits of fish are used. With this tackle are caught the cod, coalfish and haddock (*Gadus morrhua*, L. *G. virens*, L., *G. aeglefinus*, L.), the ling (*Molva vulgaris*, Nills.), the thornback (*Raia clavata*, L.), and the halibut (*Hippoglossus vulgaris*, Cuv.); of the fish caught part is sold fresh but the greater part is prepared as "stockfish" or salted, either by Norwegian merchants or by fish-curers in the province of Bohus. From the liver "cod liver oil" is prepared, and the roe is salted, to be afterwards sold for bait to the sardine fisheries in France. The annual revenue of these fisheries in Skager Rack, together with the revenue of the mackerel and the lobster and oyster fisheries carried on in the province of Bohus, is computed at 1,339,500 Swedish crowns. Besides this, statistical reports from the province of Scania give the value of this fishery at 308,600 Swedish crowns; and as no statistical reports concerning the fishery in question in the other provinces are to be had, it may for these provinces, without exaggeration, be estimated at an annual sum of 351,900 Swedish crowns, which makes the annual revenue of these fisheries for the whole kingdom, in round numbers, 2,000,000 Swedish crowns.

C. *The Lake and other Freshwater Fisheries*, with the exception of the salmon fishing, are, in the south and central parts of Sweden, carried on principally for the perch (*Perca fluviatilis*, L.), the pike perch (*Lucioperca sandra*, Cuv.), the pike (*Esox lucius*, L.), the bream (*Abramis brama*, L.), and other fishes of the carp tribe, as well as for the turbot (*Lota vulgaris*, Cuv.), the eel (*Murena anguilla*, L.), the lampern (*Petromyzon fluviatilis*), and the smelt (*Osmerus eperlanus*). A tolerably good income in these parts of Sweden, with the exception of the westernmost districts, is is also to be had from crayfish (*Astacus fluviatilis*), which are often very numerous in the smaller lakes and rivers. In the lakes in the north of Sweden especially, are caught some species of the genus *Coregonus*, and also the above-mentioned species. The fisheries in the lakes are carried on as a livelihood by a population of fishermen residing on the shores; as a subordinate pursuit by farm people, cottagers, artisans and soldiers, who either possess fishing-licenses or have procured such by agreement. The products of these fisheries are mostly disposed of in a fresh state in the neighbourhood of the fisheries, but of late years part of them have been preserved in ice and exported to Germany. The reports concerning the revenue of these fisheries are very incomplete, but the annual revenue of all the lake and freshwater fisheries, has been estimated in round numbers at 2,000,000 Swedish crowns, which is no doubt much too little.

D. *The Salmon Fisheries.*—The richest of the many salmon-streams of Sweden are the Torne, Lule, Ume, Angerman, and Ljusne rivers in Norrland, and the Viska, Ätran, Nissa, Laga and Qvistrum in the west of Sweden. A great quantity is also taken in the Lake Wener. The salmon fisheries are carried on in the Norrland rivers from the end of May until the beginning of September; in the rivers of the west of Sweden from the beginning of April until the middle of July, and along the coasts of Scania and Blekinge in the winter months, if the ice does not prevent. The largest salmon fisheries in the country are those at Elfkarleby in Upland, and at Mörrum in Blekinge. The salmon caught in the rivers on the west coast is considered better than the salmon taken in the rivers on the east coast, and is quite as good as the Scotch. The salmon is now-a-days mostly sold fresh either in Sweden or abroad, in which latter case it is packed in ice and exported, via Stockholm, Gothenburg, or Malmö, by wholesale houses to England and Germany, especially to Berlin. The greater part of the salmon taken on the south coast of Sweden in winter is sent to Germany or Denmark to be smoked. The annual revenue of salmon-fisheries may safely be estimated at 625,000 Swedish crowns.

E. *The Eel Fishery* (*with Traps on the Coasts*).—Very high prices have been paid for the eel, the catching of this fish will become one of the most valuable fisheries of the Baltic. This kind of fishery is carried on from the town of Grisslehamn as far as the western coast of the province of Scania. The eel is caught by means of large traps (*hommor*), and the best time for catching it is in September and October. The annual revenue of this fishery may safely be estimated at 150,000 Swedish crowns. The value of all the fisheries of the kingdom, estimated approximately, but judging from all appearances by no means too high, should as shown above amount to—A. Herring and Sprat Fisheries, 3,865,000 Swedish crowns: B. Coast and Sea Fisheries, 2,000,000 Swedish crowns: C. Lake Fishery, 2,000,000 Swedish crowns; D. Salmon Fishery, 625,000 Swedish crowns; E. Eel Fishery with traps, 150,000 Swedish crowns—Total, 8,640,000 Swedish crowns.

For the *Superintendence and Improvement of the Fisheries* the following officials are appointed :—An inspector of the fisheries in freshwaters and on the east coast of Sweden, with two assistants and one instructor in fish-breeding. Besides these Government fishery officials, there are, in certain provinces and waters, fishery *overseers* appointed, whose chief duty is to see that the enactments relating to fisheries are observed. Of these overseers some are paid by grants from the State, others by "Landsting" and agricultural societies, conjointly with the owners of the fishing waters. The direction and superintendence of the sea-fishery on the west coast of the kingdom is entrusted to an overseer, who is under the control of the Governor of of the governmental district of Gothenburg and Bohus. For the encouragement of fisheries the Government for some years gave premiums to sea-going fishing-smacks from the province of Bohus, and in the last few years it has made effective attempts to introduce drift-net fishing in the herring-fishery off the Bohus coast, as well as in the Gulf of Bothnia. Through the liberality of the Parliament it has also been possible of late years to contribute considerable sums for the construction of several ports for the fishing trade. Besides this, the Royal Agricultural Societies of the different governmental districts contribute from their funds to the expenses of promoting the fishery interests of their respective districts. In 1869 a company was established, with the aid of the Royal Agricultural Society of that district, for insuring fishing vessels and gear for the governmental districts of Gothenburg and Bohus; and this company still carries on its operations.

K. PÅLMAN, *Commissioner's Secretary.*

SWITZERLAND.

SWITZERLAND, with a surface extent of 41,346·5 square kilomètres, has 32,520 kilomètres of running water (rivers and streams), occupying a space of 231 square kilomètres, the lake expanse amounts to 1342 square kilomètres, so that the total extent of Swiss waters is 1573 square kilomètres.

In these there are found forty-six or forty-eight species of fish, it being questionable, however, whether some of them are distinct species, or merely varieties.

The Confederation regulates the whole Fishery Industry through the Federal Council. The administration is assigned to the Forest Section of the Trade and Agricultural Department.

The Federal Law on the Fishery Industry is dated 18th September, 1875, the Council Decree concerning it dates 18th March, 1877.

The execution of the law is left as far as possible in the hands of the different cantons: some of which are besides charged, by sanction of the Federal Council, with the regulation of the fisheries in boundary waters.

The following Conventions, relating to these last-named fisheries have been concluded with—

1. Baden and Alsace-Lorraine, dated 14th July, 1877.
2. France, dated 28th December, 1880.

3. Italy, dated 15th September, 1880.

In most of the Cantons the Fishery Industry is under the administration of the Police or Revenue Departments, the police inspection being exercised through the usual channels.

For the boundary-waters on the French frontier the Swiss Convention has appointed two Fishery Commissioners, and the Cantons of Berne and Neuchatel have appointed a similar official for the inspection of the Doubs.

For the preservation and collection of spawn and young fry during the breeding season the different Cantons appoint fishery agents.

There are at present seven fishery wards in Switzerland, one near the town of Zurich, three in the Canton of Berne (belonging to the Aar, the Emme, and the Romder), one in the territory of the Canton of Zug, and two in the Upper Engadine, Canton Grisons. As the last-named are contiguous, there are in reality only six of such wards. For the restoration of free passage to fish in certain streams three fish-ladders have been erected, one in the Soane near Freiburg cut into the sandstone, one in the town of Lucerne, and one in the Looze near Cham; the two last being made of wood.

A report on the subject of water-pollution to the injury of fish, so far as concerns the Basle Industrial District, in the first place, will shortly be prepared and circulated.

In the year 1881–82 there were in Switzerland thirty fish-hatching establishments, and from them issued 3,700,000 fish, principally trout, salmon, salmon-trout, and "röthel." The Confederation awards grants to the amount of 4000 francs to these establishments. A small quantity of foreign fish has up to the present been acquired by these institutions, among them being *Coregonus*

Maraena, *B. C. albula*, *L.*, *C. Albus*, *Salmo Guinnat*, *S. fontinalis*, and the land-locked salmon.

The major portion of fishing in Switzerland is a royalty of the Cantons, exclusively so in the Cantons of Vaud, Vallais, Neuchatel, Oberwalden, Glarus and Appenzell, also in Rhoden, and, with few exceptions, in the Cantons of St. Gall, Grisons, Solothurn, and Freiburg. Private fishing rights exist principally in the Cantons of Berne, Aargau, and Ticino.

There is a Central Fishermen's Benefit Society, and four local societies (one in the Canton of Basle, two in Grisons, and one in Berne).

The following table shows the total Imports and Exports in the years 1881 and 1882 respectively:—

	Imports.		Exports.	
	1881.	1882.	1881.	1882.
	Kilos.	Kilos.	Kilos.	Kilos.
Fish, prepared, in packages, under 5 kilos.	1,424	1,391	153	23
Fresh fish	14,715	14,752	48	120
Fish, dried, smoked or salted, in packages of 5 kg. and over:—				
Stock-fish	1,449	1,286	20	9
Herrings	746	759	1	9
Other fish	932	1,027	88	71
Total	19,266	19,215	310	232

VENEZUELA.

THE Venezuelan Consul in London furnishes the following information relative to the state of the fishing industry in that Republic:—

There are no restraints upon the fishing industry in Venezuela, the sea frontage being so immense that there is abundance of fish for every one who chooses to secure it, and all are equally free to do so.

In all the larger cities near the coast fish is available every day, and much is of the very finest quality.

No statistics are kept on the subject, the supply being unlimited, and governed only by the demand.

ZANZIBAR.

THE territory of Zanzibar extends along the East Coast of Africa from Ivarsheikh, lat. 2° N. to Cape Delgado, lat. 10·45° S. It includes several islands, among which Zanzibar and Pemba are the largest and most thickly populated. In the former is situated Zanzibar, the capital and the residence of the Sultan, H.H. Sayyid Burghash. The dominions of Zanzibar reach a considerable distance into the interior, but trade in fish is confined at present to the coast and islands. North of latitude 2° S., however, there is neither fish industry nor trade, the inhabitants being either Wagunia, or belonging to Somali tribes never touching fish. Whether the whole Somali race share this objection to fish-eating I am unable to say positively, but the Wagunia and South Somalis in these dominions entirely refuse this food. I have often endeavoured to learn the origin and meaning of this peculiarity, which is undoubtedly of old standing, but have never obtained any satisfactory reply. The Somalis have a legend connecting it with their religion (Mohammedan), but as it rests on the miraculous it cannot be accepted. It is, however, commonly believed by them that leprosy is caused by fish-eating. The Wagunia have the deepest loathing for fish, but I could never get any definite reason for their disgust at this diet, further than that they considered fish the same as snakes. When travelling with them they have invariably retired altogether apart immediately any of the party commenced to cook or eat fish.

The whole of the fish caught in Zanzibar waters is retailed for home consumption ; tortoiseshell and a few pearls to the value of about £3000 annually, and a few consignments of shells are the only products in connection with fish industry that are exported. There are, however, numerous beds of pearl oysters along the coast, and vast quantities of coral and sponge, which will doubtless be hereafter utilized. Ambergris is found on the coast, and finds a ready market among the Arabs at £4 to £5 per ounce.

Zanzibar has a large import trade of dry and salt fish, principally shark and scar-fish (nguru). The imports of cured fish through the custom houses average in annual value £30,000, representing about 500 tons, about £25,000 of which comes to the capital. Almost the whole of this fish comes in native vessels from Oman, Sheher, Sur, and other districts of Southern Arabia, but of late it has begun to find its way by steamer from Aden. The only impost upon it is 5 per cent. import duty. There is a fish custom-house at Zanzibar, and a regular salt-fish market where the fish is sold wholesale, fetching on an average 12s. per cwt. It is afterwards retailed to the working population at about 2d. per lb. Dried fish is the staple animal food of the poor and labouring population both free and slave ; it is either grilled, or cooked with a little roughly prepared curry, and served as a relish with the evening meal of rice, or more commonly meal porridge, in every hut and cottage, two or three ounces sufficing for each person. Any other description of animal food is rarely within the means of natives of the labouring classes, except in the case of those residing on the coast, who at times can procure fresh fish at equally low prices, as well as a great variety of shellfish during the spring tides.

There is a considerable quantity of shark and small fish cured in the coast villages, principally for home consumption; but there are no dues levied upon it, and it is difficult to estimate the amount. The octopus is also dried in large quantities by the native fishermen, and, being sold at a very low price, is largely eaten by the natives. Its use is liable to cause a very unsightly skin disease.

With regard to the proportion of the population engaged in fishing and fish industry, it would at such short notice, be only guess-work to attempt to give statistics.

The waters of Zanzibar swarm with fish, but there can be no doubt that the slave trade on this coast has hitherto had great effect in retarding the development of fishing as well as all other industries. The excitement and profit of that nefarious traffic have proved a larger attraction to those adopting a seafaring life than the equally precarious and more prosaic occupations of the coast fishermen. This fully accounts for the large import trade, the details of which have been given, for though the climate of the Arabian coast is undoubtedly more favourable for the curing of fish, yet there are here fully seven months in the year during which the weather is quite dry and settled enough for drying fish for consumption in the country, and there is no dearth of shark and scar-fish for the purpose.

Now, however, that the efforts of Sir John Kirk, and the stringent action he has induced the Sultan to take against the slave trade in these waters, have dealt so formidable a blow to the traffic, the large body of seafaring men who have so long been engaged in that semi-piratical occupation are beginning to settle down in these dominions, and it is not unlikely that, as this body increases, they may successfully compete with the present large import trade from Arabia, and thus cheapen the staple animal food of the country.

To those who remember the scarcity of fresh fish here ten or twelve years ago, and can compare it with the regular supply which is now found daily in a commodious fresh fish market, the comparison is very suggestive; in fact, the fish trade, like every other legitimate industry, has made progress in very near ratio to the decline of the slave trade, which, since the Treaty of 1873, and more especially since the loyal co-operation of H.H. Sayyid Burghash in our anti-slavery policy, has received a check from which it will never recover, and which it may be hoped will end ere long in its total suppression.

In Zanzibar itself the class of professional fishermen is large, and along the coast there are in every town and village those who pursue that calling. There are also a great number of natives usually employed in cultivation who engage in fishing during slack seasons.

Fish here are usually caught with a hook and line of native manufacture, the fibre of the pineapple leaf, and of a species of aloe and native cotton, being used in constructing their lines, and the bark of a tree ("M'psi") employed to tan and strengthen them. Shell fish and squid are the usual baits. The canoes usually lie in seven fathoms and upwards, the fishermen being well acquainted with the resorts of the various species of fish.

Along the coast, wherever the beach is sandy, the seine is used, and large quantities of fish are thus obtained when the tide serves.

Fish are also taken in calm weather by using a poison called "Utupa," which is prepared by bruising the leaves of a shrub of that name. When thrown into one or two fathoms it instantly stupefies every fish in the locality, and causes them to come to the surface.

The variety of fish found in Zanzibar waters is very great, but it would be useless to give the native names, and not having a book of reference, it is impossible to identify them either with their popular or scientific designations in Europe. Many are poisonous, and some, though commonly eaten, are known to be liable to induce sickness and rashes. The most marketable kinds are the scar (nguru), of the larger fish, and among the smaller the "Changu-chole" (resembling the sole in flavour), the "Kibua" (a kind of mackerel), the "Koana" (red mullet), and the sole, which latter, however, is rare, owing to the difficulty of securing it with native nets. "Dagaa," a name applied to fry and small fish, generally a little larger than whitebait, are also plentiful at certain seasons.

The price of fresh fish may be considered high, being fully half as much as is paid in London for fish of similar quality.

There are no special laws for the protection either of fish or fishermen in this country.

This brief and imperfect notice of the fish and fish trade of Zanzibar may be concluded with the description of a fish whose use, so far as I am aware, has not been mentioned either by travellers or those who have written specially on fish and their habits.

The "Chazo" (sucker fish) is well known to naturalists and is constantly found adhering to sharks, whales, and other fish, and to old timbers raised from deep water. I had long heard tales of their being employed by the natives for the purpose of catching tortoise and turtle, but professional fishermen are very jealous and exclusive, and there was great difficulty in getting them to speak on the subject to a European.

On receiving the notice of the International Fisheries Exhibition, which only reached me two months since, I went among the fishermen, and succeeded in finding two or three fish, one of which I secured, on condition of my consenting to the owner taking it for one more trip, on which he was then starting. The account received from this old fisherman and his companion tallies so nearly with what was formerly heard regarding this fish that it may be looked upon as substantially accurate.

Young chazo being secured, a ring or loop of iron is let into the tails; they are then kept in a small canoe, the water in which is changed from time to time. They are fed sparingly with pieces of meat and fish, and, if they survive the confinement, soon become used to captivity and to being handled. When they have reached two or three pounds in weight, they are strong enough for use, and are taken out for trial. A line is fastened to the iron loop which has become embedded in a firm growth, and on sighting a tortoise or turtle, the chazo is put overboard. It has to be prevented from affixing itself to the canoe, and then it soon makes for the nearest floating object, to which it instantly adheres, and generally allows itself to be drawn with its prey towards the boats. Should it prove too timid to stand this treatment it is discarded as worthless, but if it will hold on, it soon gets bold enough to retain its hold until taken into the boat, when it is at once detached from the prize by being drawn off sideways, and being returned to its tank is at once fed. They are said soon to learn what is required of them, and it is reported that they have been trained to catch sharks. When in Madagascar some years ago, I was told that the "Tarundu," which the fish is there called, had been trained to catch crocodiles, numbers of which infested the rivers and, as as I observed, came down to the neighbourhood of the fishing villages on the coast, without being affected by the salt water.

I hope to forward a specimen of this interesting fish before the close of the Exhibition. I am not aware how far beyond the tropics it can exist, but it is not impossible that it may be utilized even in European waters.

FRANCIS HOLMWOOD.

Zanzibar, May 29th, 1883.

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